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THE KANSAS CITY REVIEW OF SCIENCE AND INDUSTRY.

EDITED BY

THEO. S. CASE.

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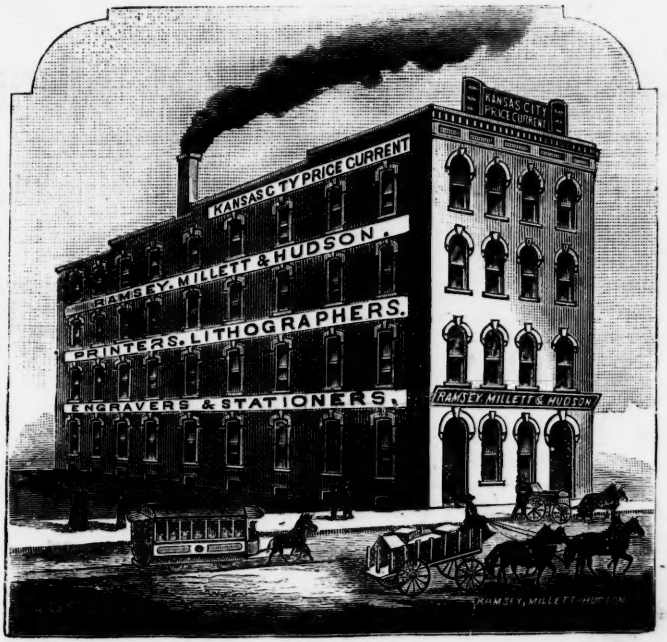

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SCIENCE, MECHANIC ARTS AND LITERATURE.

VOL. VI. JANUARY and FEBRUARY, 1883. NO. 9-10.

ASTRONOMY.

TRANSIT OF VENUS, DECEMBER 6TH, 1882.

EDGAR L. LARKIN, NEW WINDSOR, ILLINOIS, OBSERVATORY.

The beginning of the transit was witnessed at this observatory. The sun rose clear on that eventful day, and the winds were hushed into a calm, while the atmosphere was in fair condition for telescopic manipulation.

The sky at sunrise, 7h. 15m., was clear in all directions, and remained so until 7h. 30m., when faint tufts of clouds in rapid motion appeared in the northwest. A light but cold wind began, and in a few minutes heavier cloud-masses appeared—the fore-runners having reached the zenith, moving rapidly eastward. At 7h. 50m., a huge bank of lead-colored clouds had attained an altitude of 50 degrees in the west, and matters assumed a dubious appearance. The hopes and expectations cherished from boyhood seemed about to be crushed by overwhelming disappointment.

At 7h. 55m., a cloud detached itself from the rising wall and moved toward the sun, obscuring it at 7h. 58m. Surely the times became critical, for the transit by computation made for the longitude of New Windsor was to begin at near 8h. 1m. The cloud must move away in three minutes, or we would fail to behold the first contact.

We remark that five minutes before the calculated time of contact we set the

telescope precisely on Venus by means of its computed place in space, as found in that admirable work, the "American Ephemeris." To parties not familiar with these things, we have to say that of course Venus was invisible, but we placed the telescope accurately on the unseen world by the aid of two gradua'ed circles of metal called the Right Ascension and Declination circles, which are rigidly attached to their respective axes on the equatorial.

These, in connection with a sidereal c'ock, enable one to set the telescope on any invisible celestial object whose position is catalogued. Thus: any star can be found at noon, as well as at night, the observer not looking at the sky to find the object, but upon the verniers near the ruled edges of the measuring circles.

By this method the glass was placed on Venus before it came in sight between the earth and sun, in order that precious time might not be wasted in adjustment when it made its appearance.

At 7h. 59m. the sun was still obscured, but the cloud had nearly passed to the east, light appearing on its western side with increasing brilliancy, when at 8h. the sun burst into view.

Instantly we began close scrutiny, striving to detect the first indentation on the solar edge by the advancing world. A watch regulated with great precision, and indicating mean Washington time, was placed on the telescope close to the solar eye-piece, so that a reading of its seconds' hand could be made in an instant. There were three time-pieces in the observatory, all regulated with care. One read sidereal; another, mean Washington, and the other mean solar time at New Windsor.

Through the kindness of Vice-Admiral Stephen C. Rowan, U. S. N., Superintendent of the Naval Observatory at Washington, and the courtesy of the Western Union Telegraph Company, we received accurate time by telegraph direct from the mean solar clock at the observatory in Washington, hearing its seconds' pendulum beat in New Windsor. These time signals were sent at mean Washington noon on December 4th, 5th, 6th, and 7th, by direct circuits to receiving observatories. This was a work requiring great care and skill on the part of the officers, since receiving stations were in all directions from Washington, but must receive the signals at the same instant of absolute time from the same clock.

We insert the scheme for the transmission of time, devised by the American Transit of Venus Commission, and put into successful execution on the days mentioned. We quote from the circular issued by the Commission to observatories: "The signals to be sent out by the observatory are wholly automatic, and consist of a series of short breaks, so made in a closed telegraphic circuit as to represent the beats of a mean-time clock. They begin at 11h. 56m. 30s., and close at 12h. om. os., Washington mean time. During the interval there is a break at the beginning of every second except that in each minute the breaks corresponding to the 29th second, and to the 55th, 56th, 57th, 58th, and 59th, seconds are omitted. Thus, the first break after the pause of five seconds always marks the beginning of a minute, and the first break after the pause of one second marks 30

seconds. At 12h. om. os., there is only a single break, and then the signals cease." At 11 A. M. each day, New Windsor time, we visited the telegraph office with two regulated watches: One indicated mean local solar time, and the other was wound, but had the balance-wheel stopped by a wedge of paper, the hour, minute and second hands being carefully adjusted at 12h. om. os. At 10h. 50m. the officers of the telegraph company ordered all business to stop on the line leading through New Windsor, and that no key be opened. At a time which was 11h. 56 m. 30s. in Washington, we heard the first "click" on the magnet, and at the same instant looked at the seconds' hand of the watch recording local time, and behold! it read 11h. 2m. 37s. Therefore the difference in time between Washington and New Windsor is 53m. 53s.; or, in other words, the longitude of this place is 53m. 53s. west. Here is a record of the time as checked on receipt:

Washington Time. *Received.*			New Windsor Time. *As Noted.*		
H.	M.	S.	H.	M.	S.
11	56	30	11	2	37
11	57	—	11	3	7
11	57	30	11	3	37
11	58	—	11	4	7
11	58	30	11	4	37
11	59	—	11	5	7
11	59	30	11	5	37
12	00	00	11	6	7

All the beats and break seconds of the Washington pendulum were distinctly heard over the long wire the same as though we had been in the Naval Observatory; while, in our telegraph office, the regular beating of the clock seemed most impressive. At 11h. 59m. 45s. we placed the point of a pen-knife on the paper stop in the balance-wheel of the silent watch, to be in readiness for the final beat at precisely noon in Washington. In due time it was heard, the wedge was instantly removed, the tiny balance began pulsation, and we had absolute Government time. This was repeated each day to learn the error in twenty-four hours of all the time-pieces.

This watch, reading Washington time, was placed on the telescope just before the time of the transit on December 6th, and we began to look at 8h., remaining motionless, so that vision might not be disturbed. We gazed intently for one minute, and no world came in sight. Could we have made an error in calculating the local time of beginning for this longitude? Another half minute passed away and no notch on the sun was seen; then eleven seconds elapsed, when, behold! a delicate line of black appeared on the southeastern limb of the sun! It was the transit of Venus! Instantly reading the watch keeping New Windsor time, it indicated 8h. 1m. 41s.; and by its side the watch having Washington time read 8h. 55m. 34s., the difference in the reading being 53m. 53s., as learned by telegraph, and also by astronomical methods.

Since astronomical time begins at noon, and counts to 25 hours, we may say that contact I. began December 5th, 1882, at 20h. 55m. 34s., or December 6th, 1882, at 8h. 55m. 34s , mean Washington, or 20h. 1m. 41s., mean local time. But all our labors will prove of no value to science, as we are still in doubt as to the actual time. We are not sure whether the time was 8h. 1m. 39s., 41s. or 42s., all because the cloud was followed by a train of vapors that caused the sun to "boil" furiously. All the care of the telegraph company, the trouble of regulating clocks and watches and other labors will be of no real value, we regret to say, so far as this observatory is concerned, since there is an uncertainty of three seconds—an error that will destroy the result of any delicate astronomical computation. To telescopists we remark that this vapor mass caused a violent "boiling" of the solar periphery, making it assume the appearance of a seething, turbulent mass of fire, in such agitation as to preclude anything like accurate determination of time of contact. The planet advanced, cutting a deeper and deeper curved black space from the solar limb until, when two-thirds on the sun, a most beautiful spectacle was seen. This was a semi-circle of light suddenly made visible on the external edge of Venus, and was caused by the refraction of the sun's rays by the planetary atmosphere.

The air on Venus must be deep—much deeper than that on earth; for, near as we could judge without micrometrical measurement, we should say that the band of light was equal to one-thirtieth the radius of Venus. Some say the earth's atmosphere is 45 miles deep; others think it is a hundred, but one hundred miles is only the one-fortieth part of its semi-diameter.

Finally the moving black sphere approached contact II., that is, the external edge came within the solar periphery.

The vapor in our atmosphere at the time was dense, and the "boiling" furious; but the time of internal, or contact II., near as possibly could be determined, was 8h. 22m. 20s., Venus requiring 20m. 39s. to traverse a distance equal to its own diameter, as projected on the sun, and seen from the earth. This time would have been much shorter had the earth remained motionless in its orbit, but our world moves in the same direction around the sun that Venus does, though not so fast, hence the apparent motion of Venus on the sun was what it gained on the earth. We saw no "black drop," a phenomenon sometimes seen at transits of Venus, when a dark band lingers a few moments between the edges of the sun and Venus. When the planet was fully on the solar disc, we made close examination, hoping to detect a halo around it caused by its atmosphere, but failed to see it, but the seeing was not first-class, owing to the turbulence in the terrestrial atmospheric envelope. The angular diameter of the sun is 1,924 seconds of arc, and that of Venus at transit was 65, hence the apparent diameter of the sun was 29.6 times greater than that of the planet moving across its disc. The scene was calculated to impress one's mind with sublimity, and when we saw the first contact we could not repress a sense of admiration for those students who made known the minute details of that vast mechanism, the solar system, and calculated the phenomenon one hundred years ahead—true to less than one minute of

time. Contemplation of such magnificent works of nature cannot fail to make men desire more knowledge, and to awaken in them a spirit of research into still more profound labyrinths. The closing scene then began, the mighty cloud-bank drew nearer the sun, and finally put out its light at 9h. 5m., hiding from our eyes the glorious view forever, as another transit will not occur until June 8th, 2004. An appalling storm raged for thirty hours, the thermometer reaching a depression of 13° below zero. We append a table of results as deduced at this observatory:

RESULTS.	CIVIL TIME, DEC. 6TH, 1882		
	h.	m.	s.
Mean local time of contact I	8	1	41
Time of transit across solar limb		20	39
Mean local time of contact II	8	22	20
Mean Washington time of contact I	8	55	34
Mean Washington time of contact II	9	16	13
Astronomical time of contact I., New Windsor, Dec. 5th, 1882	20	1	41
Astronomical time of contact I., Washington, Dec. 5th, 1882	20	55	34
Longitude of New Windsor (West)	—	53	53
Probable error	—	—	23

Latitude of New Windsor, 41°, 13′.

DECEMBER 20th, 1882.

ARCHÆOLOGY.

THE KITCHEN MIDDINGS OF MAINE.

PROF. F. W. PUTNAM.

During the months of November and December, 1882, Professor Putnam, Curator of the Peabody Museum of Archæology, delivered a series of five lectures on "American Archæology" at Cambridge, Mass. These lectures were partly in the nature of a report to the subscribers to the fund for such researches of his explorations during the past summer, and partly to arouse among others an interest in the subject by describing the methods pursued in systematic explorations, and by exhibiting the results.

We copy from the Boston *Transcript* a report of the first lecture of the course, having the above title.—[ED. REVIEW.

"The specimens on the table before you may seem insignificant, and some of them you may even look upon as 'scientific dirt,' but they will serve to show you the material of which shell heaps are composed. But first, I will answer a question which has probably occurred to many of you, and that is, 'What

is a shell heap?' It is simply the refuse pile of a village, or family, of a large or small number of people living for a time at one place. Kitchen-midding is one name which has been given to such deposits, and they have received the common term of 'shell heaps' in this country, simply from the fact that the many and often immense banks of shells which occur along our coasts and on our river sides were known as shell heaps or shell banks long before it was known that they were formed by the hand of man. The specimens in the trays which I have passed about were taken from three parts of a large shell heap at Keene's Point on Muscongus Sound.

"This heap is four or five feet thick on the water edge, and extends several hundred feet along the shore and a hundred feet inland. In the upper part of the heap, just under the sod, the shells are much broken; in the central portion they are often reduced to a fine powder, and mixed with the ashes found throughout the heap; in the lower part the valves of the shells are often whole, and are filled with the soil upon which they fell when the refuse pile was started from the material thrown aside by the first inhabitants of the place. In this next tray are perfect valves of the common clam (Genus *Mya*), which enters most largely into the formation of the heap, of the quahaug (*Venus*), of the scallop (*Pecten*), of the whelk (*Buccinum*), and of the cockle (*Natica*). The bivalves were, probably, commonly opened by roasting, after which the animal was eaten and the shells tossed aside, so that you will seldom find together the two valves belonging to the same shell. Some valves of the quahaug and also the shells of the whelk and the cockle have been found broken as if by a hammer before cooking.

"In addition to the shells, bones of animals were obtained in great number. Most of these are broken into small pieces, probably for the double purpose of getting at the marrow and of reducing them to a size adapted to the ordinary cooking pot. Although the bones of mammals were more often those of the moose, deer, bear, wolf, fox and beaver, yet there were also found bones of the otter, skunk, fishes, coon, woodchuck, seal and porpoise. Bones of several species of birds occurred, also some bones of the turtle, while fishes were represented by the cod, flounder and great goose fish, giving with the mollusks quite an extended bill of fare. The bones and shells were broken with hammer-stones, which are found scattered through the heap. These stones were probably picked up on the seashore and kept about the house or near the fire so as to be handy for use in preparing the food.

"Beside these rude stone hammers we find occasionally an implement so rude in character that you might think it to be a stone picked up at random on the shore, but on looking more carefully you will see that it is chipped, with the evident intention of forming a pointed implement with a cutting edge. I will pass about a tray containing other tools and chips of stone, which, though generally known as arrow points, I am inclined to believe to be rude knives, which were probably set in wooden handles. These little circular pieces of stone, you will see, have had from twenty to thirty little chips taken off the thick, rounded edge, fitting it for cutting or scraping, and such implements are known as scrapers. So

many chips of stone were found in the heap as to lead to the inference that the implements were made upon the spot. It is seldom that we find in a shell heap anything exhibiting a great amount of labor in its manufacture. From this heap, however, I procured one polished celt, which had been carefully chipped and pecked, and then rubbed on a coarse stone, like sandstone, to sharpen and polish the edge. In the shell heaps of Maine I have found more objects of stone than have been found in the explorations of heaps south of this point, stone implements being usually scarce in shell heaps. Implements made of the bones of deer and of birds are comparatively common in all heaps, and here I have found bone points or perforators and bone spear points in shape like huge crochet needles, which is the primitive form of harpoon the world over. Another harpoon in bone, the only one of its kind which I have seen from the Atlantic coast, but a common form upon the Northwest coast, is this specimen found and presented by Mr. A. T. Gamage of Damariscotta. It is a harpoon point having a hole in its shank through which a string was passed attaching it loosely to the shaft of wood into which it was inserted. When a fish was speared, the shaft would be set free by the struggles of the fish, and floating its line's length upon the water, would guide the fisherman to his prize. The discovery of the art of pottery seems to have been made during the immense time these heaps were being formed, as I have not found fragments of pottery in the lower portions of the older and larger heaps, while such fragments are common in the upper beds and in the more recent heaps. The specimens from Maine are of a rude type, thick and heavy, and composed of a mixture of clay and pounded clam shell. The lines of fracture show that the pottery was made by the coil method, common not only among our Indians, but among the primitive potters in various parts of the world. The ornamentation is of the rudest character, made up of incised lines or by the impress of twisted cord. The last method is instructive, as it shows that the people understood the art of twisting fibres into threads and cords. Few personal ornaments occur in shell heaps, but I hold here a canine tooth, grooved about its root as if for suspension as a pendant.

"While the Keene's Point shell heap is made up largely of clam shells, other heaps occur which are composed almost entirely of oyster shells, as, for instance, the immense heaps at Damariscotta and Newcastle, situated opposite each other on either side of the Damariscotta River. I would call your attention to the fact that this is an old-fashioned oyster, for which one might now hunt for days, although it was once abundant on the New England coast. It is slender and long, many being even fourteen inches in length. Old men at Damariscotta say that their fathers have sometimes seen one, but it has probably never been abundant since the time of the earliest settlement, so that we must believe that these great heaps were formed long before that time.

"Human remains are not common in the shell heaps of the Atlantic coast. In Florida, however, Prof. Wyman discovered in the shell heaps masses of broken human bones, which are considered to be the remains of a cannibal feast. There are some indications that cannibalism existed among the shell-heap

people of our northern Atlantic coast, but the evidence is not yet sufficient to justify the assumption. In the great shell heap at Newcastle a human skeleton was found, a few years since, which was given me by Mr. Charles Metcalf; and in a shell heap on Fort Island in the Damariscotta River, Messrs. Gamage and Phelps discovered portions of five skeletons, of which these two skulls and these bones form a part. The skulls are long, like those of our New England Indians.

"For the general consideration of shell heaps, I will refer you to the chapter on the 'Danish Kjökken-moddings, or Shell Mounds' in Lubbock's 'Prehistoric Times;' and for an account of the American deposits, to the memoir by Dr. Jeffries Wyman on the 'Fresh Water Shell Mounds of the St. John's River, Florida,' and to his papers in the *American Naturalist*, Vol. I, January, 1868, and Vol. II, 1868. A sketch of the Atlantic coast shell heaps will also be found in Dr. Abbott's recent work, entitled, 'Primitive Industry.'"

The second lecture of the course was upon

THE STONE GRAVES OF BRENTWOOD, TENNESSEE.

"Brentwood is situated on the Little Harpeth River, fifteen miles from Nashville. The central portion of the farm is a natural elevation, surrounded by low land running off to the Little Harpeth. Two very cold springs rise on the side of the hill. This beautiful spot was chosen by the Stone-Grave people for a village site. Here they dwelt and cultivated the land, raising corn, squashes and beans. The character of their houses is not known, but probably these were framed of upright posts, roofed with branches, and covered in with bark or clay. Some such structures have left, by their decay, circular ridges of earth, showing the outlines of the houses. In the Annual Report for 1878 is a diagram of one of these towns which I explored and a description of objects found at that time, which are of the same character as those found since in this region

"The distinguishing feature of these people is the burial of their dead in stone graves. Stone graves occur from Kentucky to Alabama and Georgia, but are more numerous in the Valley of the Cumberland than in any other part of that great region. Occasionally similar graves have been found outside of these limits, as in Ohio, Illinois, and even in New Jersey, but these isolated cases may or may not be of the same people, since similar cists, or stone graves, are also common in various parts of the Old World. To open these graves and remove their contents may seem like sacrilege, but there is no other way to study the history of this people, and again if they were not opened for science, their contents would be turned over by the plough, as is now the case every year. From the Cumberland Valley there have been brought to the museum the contents of several thousand stone graves, forming by far the largest collection ever brought together. On the farm at Brentwood the graves covered a knoll or small hill; upon the top of the hill they were very numerous and close together; on the sides groups of graves were found, or here and there a single grave.

"The bottoms of the graves were usually paved with fragments of rude pot-

tery, or with small, flat stones; the sides and ends formed by great slabs of limestone, and the whole covered in with one or more slabs of limestone. The average length of the large graves is six feet, their width averages about eighteen inches and their depth ten inches. The slabs forming the sides and ends are sunk a few inches below the level of the bottom of the grave. The covering stones sometimes fitted tightly, but often they were laid across and covered by others, in one case even to the number of fifteen. Besides these large graves small graves, one to two feet long, occur, in some of which the bones are found out of the natural position, as if they had been brought to this place for re-interment; other small graves are those of children. In most of the graves only the bones of a single skeleton were found, but some contained the remains of two or more bodies, and in several graves there were skeletons of adults and children. It was from finding the bones of children and from the size of the smaller graves that there arose in early American archæology the story of a race of pygmies.

"From the eighty graves explored at Brentwood I succeeded in removing forty skulls and many skeletons One grave five feet nine inches long by two feet wide and one foot deep, contained the remains of five bodies—three of adults and two of children. Two of the adult crania have a persistent suture down the middle of the frontal bone, which is rare in the crania of barbarous people, so that it is rather remarkable to have found two skulls presenting this feature in the same grave. A very great intricacy of the sutures of the back of the head is a common character among short-headed people, but, besides numerous supernumerary bones in this region, one skull shows a suture across the parietal never before seen in our collection. Several other skulls are remarkable, one for the great projection of the jaw, another for anchylosis of the skull and first vertebra of the neck, greatly impairing the freedom of movement of the head; still another has the two middle incisors set a little apart, while the lateral incisors seem never to have developed. In one grave the skull of a very old person was found lying on the pelvis of another skeleton, such a mixture of the bones of different persons being not uncommon in these graves; often a single bone, the clavicle or some limb bone, is found buried with the complete skeleton of another individual. The bones bear mark of accident and suffering such as afflict the people of the present time—fracture of the cranium, resulting in death; broken limbs, repaired during life; some shinbones curved and others thickened, as if by rheumatism or some other inflammatory process. An arrow point lodged in a vertebra from the middle of the back, between the shoulders, was probably the cause of the death of the person. Many of the bones are reduced nearly to dust, and others are so very fragile as to prevent our removing them from the graves. From this we could infer a great antiquity for these remains had we not learned that we cannot compute the length of time which has elapsed since the burial by the condition in which the bones are found, for in the matter of time required for the decay of bone, there are great individual variations. One condition alone serves us for a general test of the antiquity of bones. The black oxide of manganese, of which there are but minute quantities in the soil covering any buried

body on the top of a hill is absorbed by the water percolating through the soil, and in solution penetrates the substance of the bone in which it is deposited, giving rise to smaller or larger black dots and dendritic forms, such as are seen in some of these bones. When there is considerable of this black dotting we know that the bone has been exposed for a considerable time to this slow process.

"In these graves many objects were placed with the dead, which friends may have thought necessary for their future life. It is curious that while upon the surface of this region immense numbers of stone implements or weapons of good form and finish may be picked up, the stone-grave people seem to have seldom buried these with their dead. One celt, a few knives and some chips embrace all the stone objects brought from the stone graves explored this summer.

"Food and articles of domestic use, or for personal adornment, make up the list of contents of the graves. The broken bones of animals would seem to indicate that cooked meat was placed in the grave, while the shallow dishes common in these graves probably contained some soft edible, as spoons were often found in them. These spoons were cut from the right valve of the *Unio* or fresh-water clam, and often the handle was notched or more elaborately ornamented. They are made for use with the right hand. The best pottery of the region is thin and black; the most common form is that of the small shallow dishes, notched about the rim, which have just been mentioned. A dish like a ladle. and one like a large cup with a hole on either side just below the rim, for suspension, are duplicated in our former collections from stone graves. The most difficult work of the potter of this region was probably to mould the heads of animals or the human head, as is so commonly done on the upper part of water bottles from this locality. This is similar to the highest order of potter's work among the mound builders of the Ohio Valley, showing a similar stage of development reached by these two peoples, for the potter's art is the key to the attainment in culture of an early people.

"Many little objects of pottery, images and tiny dishes, are, I believe, the playthings of the children; for whenever I have removed them from a grave, it has been either from the grave of a child, or if that of an adult, it is one in which a child was buried with the grown person. Coarse pottery in fragments lines many of the graves. In one grave there were large potsherds, to the number of more than thirty. In another grave there were pieces of burnt clay, in which were the impressions of reeds. Here is one pipe of clay, unfortunately somewhat broken.

"As a rule, pipes are very rare in stone graves, not more than ten having been found in the thousands of graves which I have opened.

"Many pottery beads were found of the same shape as the commoner shell beads. A single pearl bead, formed by perforating a larger pearl, was found. Near the head of one body lay a long, slender pin of bone. In a grave containing a perfect skeleton were found two fragments of a human cranium, which had been whittled into their present shape and laid in the grave, but for what purpose is unknown. Though former explorations have brought to light quite a number

of copper articles in stone graves, none were obtained from this particular group.

"Descriptions of stone graves will be found in C. C. Jones' 'Antiquities of Southern Indians,' chapter 10; in 'Explorations of the Aboriginal Remains of Tennessee,' by Dr. Joseph Jones; 'Smithsonian Contributions to Knowledge,' 259, 1879, and in the 'Eleventh Annual Report of the Peabody Museum.'"

The third lecture was entitled

THE ANCIENT CEMETERY AT MADISONVILLE AND ITS PECULIAR ASH-PITS.

"In the valley of the Little Miami, three or four miles from Madisonville, are extensive woods of oak and walnut, where the hogs were allowed to run wild, and, by their rooting, uncovered human bones, stone implements and potsherds. In 1878 this attracted the attention of the gentlemen composing the Madisonville Literary and Scientific Society, prominently Dr. C. L. Metz and Mr. C. F. Low, who caused an exploring trench of some length to be dug, and having thus ascertained the place to be the site of an ancient cemetery of considerable interest, entered at once upon the work of scientific investigation, in which the museum has since taken an active part, and the Curator has made two extended explorations in person. A part of the large number of specimens collected during the past season was arranged on the table.

"The surface was found to be covered with leaf-mould of an average depth of eighteen inches, below which is the hard clay of the region. In the leaf-mould and occasionally a few inches in the clay are found the skeletons, sometimes extended, and sometimes out of the regular position, as if the body had been buried in a bundle, or the bones had been brought here for reinterment. The burials were made here and there without order, but in great number, about one thousand skeletons having been already discovered. Under the leaf-mould many round pits, dug in the hard clay. have been found, the object of which is one of the great puzzles of American archæology.

"These so called 'ash pits' are sometimes isolated, but often in clusters. Seven hundred have been found in this cemetery, to which they are, so far as is at present known, peculiar. The pits are commonly about three feet in diameter by three or four feet deep, and are filled with fine light gray ashes to near the mouth, where some sand is mixed with the ashes. Human skeletons have been found in two pits, in one instance at the bottom of the pit, and in the other half way down. Human bones have also been found in such positions as to show that burials had occasionally taken place in the clay before the ash-pits were dug, while in other cases skeletons in the leaf-mould had been removed in order to dig a pit. The plan followed in exploring the cemetery has been to divide it into blocks, whose corners were marked by four large trees. In one of these blocks explored this summer were found fourteen ash pits dug in the clay, and six skeletons buried in the leaf-mould.

"The human bones on the table show us that the skeletons from the leaf-mould are those of people of about the average height. The tallest person of all measured five feet eight and a half inches. They were brachycephalia. Their shin-bones show a tendency to flattening. At least half of the upper-arm bones are perforated at the lower end, a peculiarity not often found among civilized people. One femur with its corresponding tibia is thickened by inflammation, while two leg bones show repaired fracture, one near the middle, the other at the lower end.

"With one old man were buried a small stone-pipe and a jar. This jar, as well as all the pottery from the leaf-mould, is of a lower type than that from Tenness or Missouri, but it has two distinguishing peculiarities. The dishes have broad flat handles, sometimes two, but oftener four, which are wider above at the rim and below where they are joined to the dish than in the center. These handles are often replaced by the moulded forms of salamanders having the head at the rim, or looking into the dish. Besides these peculiar features, the pottery is not remarkable in its ornament, being cord-marked or incised. Occasionally big lozenge-shaped figures are cut upon it.

"Stone and bone implements are found buried with the skeletons in the leaf-mould, but no implements of copper. Ornaments of copper are not rare. Upon the neck bones of a child buried with an adult a lot of cylindrical copper beads were found, and with them a cross-shaped pendant. Finger-rings were so uncommon in American prehistoric times that, in exploring several thousand graves, I have only come upon them in one grave, which was opened this summer in the cemetery at Madisonville. The skeletons with which the rings were found was that of a woman, and the rings were broad bands of copper, two upon each hand, still remaining on the phalanges.

"In the ashes filling the ash-pits are found the bones of almost every animal known to have lived in Ohio, from the size of the buffalo to that of the woodchuck, but the most common are those or the deer, wolf, bear and beaver. The long bones are broken as if for cooking. Bones of fishes and reptiles occur, and the spurred leg of the wild turkey is often met with among other bird bones.

"Bone implements are very common in the ash-pits. One, whose pattern is unknown anywhere else in the world, was made out of the leg and foot-bones of the deer and elk by cutting a groove along the bone and beveling its edges from within, so as to render them quite sharp. This implement we call a scraper. As the edge became dull it was probably sharpened again and again, until, with continued use and sharpening, it became so thin in the middle as finally to break, and so we get great numbers of the ends of such scrapers, as shown by this tray full.

"Digging implements, made from the antlers of the deer and elk, some more like picks and others more like spades, were probably mounted in handles, and may perhaps have served to excavate the pits in which they are found in great quantities. It would require many digging implements to make so many of these large pits in the hard clay, and it has occurred to me that the massive, perforated

shells of the *Unio*, so common in these pits, may have been mounted on handles and used as scoops. Perforators of bone are common; long, slender needles of bone are not rare, while two or three bone comb-like ornaments, having three or four teeth, have been found in the pits.

"Fragments of pottery are plentiful in the ash-pits, but only three perfect dishes have been found in them. Stone implements are also very common, including hammer stones, celts, scrapers, arrowheads and rude knives.

"Not far from the cemetery is a large earth mound, and near by the cemetery are nine earth-circles, which had probably never been disturbed since their formation. These earth circles are from forty to sixty feet in diameter, and are surrounded by embankments averaging two feet high and nine feet wide, which were probably formed by the decay of the walls of the houses of the people formly living here. Now the embankments are covered with verdure. Within the circle the accumulated soil is from seventeen to twenty inches in depth, and on removing this we come upon the compact clay with a central pile of ashes over burnt clay. Fragments of pottery were found near the ashes in great number, of a similar character to those in the cemetery. The singular perforated *Unio* shells also occur within the circles, and stone implements. Pieces of cannel coal from which jet ornaments were probably cut were also found. These are some of the signs of use and habitation which leave, I think, no reason to doubt that the earth-circles are the sites of houses.

"For all that has been said before on the subject of this ancient burial spot, I refer you to the journey of the Madisonville Literary and Scientific Society; to the Proceedings of the Boston Society of Natural History Vol. XXI, May 18, 1881, and to the Harvard Bulletin, 1881."

THE STONE AGE IN OREGON.

There is a little mine of antiquities of the most interesting kind upon the point of land at the junction of the Columbia and Umatilla Rivers. The ancient tribes doubtless made this stern and sterile river bank a place of sepulture for their dead, and the Umatillas more recently have also buried their dead in the same sandy cemetery. Many interesting curiosities from those old, forgotten tribes have been discovered by the casual seekers, and doubtless many of equal interest and value await the more thorough antiquary who will search patiently and systematically the ancient "memloose illahee."

In a few minutes' search at random along the shore of the Columbia, I have found a half dozen relics of the prehistoric Americans of this locality. Searching among the beautiful polished stones along the bank at the east of the Umatilla and south of the Columbia for suitable stones to be decorated with the typical Mount Hood, to grace a writing table or throw at caterwauling felines, I picked up a stone which was remarkably perfect in shape—a perfect circle, polished smoothly, and only marred by a hole through its rim. I was about to "skip it" into the

river when the peculiar cutting of the hole, which I at first thought an accident, attracted my eyes, and I found the stone was cut by some being human with pains, which no one at this day can tell us distinctly of, to be perhaps the cover of some vessel or a weight for a fishing net. But a dozen steps farther on I found a stone about the size of a base ball, perfectly round but with a groove half an inch deep running around its widest circumference, giving it a singular symmetry. This was probably used either for a net-sinker or a sort of pestle. A symmetrical stone, hard, smooth and shuttle shaped, about two inches in diameter and nine inches in length was the next find, and with it an old fragment of granite cut into a pestle, which any apothecary of our own day would recognize as a sign manual. The granite one was made with a top cut probably to the shape of the hand, with a rim to prevent its slipping from the grasp, and a macerating end tapering to a larger diameter. I consider this was an ancient relic, because of its chipped edges, worn away by grinding in a mortar as hard as itself.

Bits of bone and small smooth pebbles, nearly of uniform size, a trifle smaller than the silver half dimes, lie scattered about in many places among the sage brush. Occasionally also a perfect and symmetrical stone head is discovered. These three are parts of necklaces, the larger stone beads being worn by the warrior as bears' claws and teeth are now worn by the Sioux and kindred nations; the smaller bone beads by the women. I saw in a valuable and intensely interesting collection of these relics of ancient art, pride and utility, which are in the possession of Capt. J. H. Kunzie, three fine complete necklaces of polished stone beads, of various symmetrical shapes—found, oblong, cylindrical, square, and some of the beads weighing two ounces each. In the same collection are also necklaces of long, white, needle like shells, by common appellation "wampum," the money of the aborigines.

Several fine old stone mortars are also in the collection of Capt. Kunzie. One is of gray granite, handsomely fluted around its outside surface, a broad bead or band as its top, and its bowl symmetrical and smooth. Another, probably made from stone which crops out near the place where it was found, was probably made by later tribes in imitation of the old vessels, which in nearly every case are made from rock which cannot be found upon the banks of the Columbia in a thousand miles of travel, and which is not known to our geology west of the Blue Mountains, except in such cases as the present, where it has been brought to the sand of the Columbia by tribes from the eastward. The Umatillas have a tradition that these people were of the Crow nation. In the memory of the oldest Umatillas the implements and ornaments mentioned have not been used by the tribes on whose lands they are found. The Umatilla, Wasco, Klickitat and many other tribes, barter arrows and spear-points of beautiful shapes, and colors to vie with the agate, yet not one of them can tell how or by whom they were made, and the art is lost.

A word about the most wonderful discovery in this ancient Golgotha, which was unearthed by the gale of March 28th, and found by Master Seymour Kunzie.

Upon a first examination it strikes one as an Assyrian or Egyptian carving,

the features and style of ornament being much nearer those wonderful oriental relics of antiquity than our Northwestern Indians would be thought capable of. The use of this interesting relic was probably for a grinding bowl, though its grand, sphynx-like form suggests a nobler use. It is in nearly every case conjecture, when we speak of the purpose which these ancient vessels were intended to serve. This great curiosity is cut from reddish-gray granite, and would require a block a foot square for its dimensions. Its front is a human face, distinct, dignified, and in some aspects, even grand in outline. It is carved with a skill which could have copied nature, yet there is no point of resemblance between the face and that of any modern Indians. Its brow is broad and low, and the wide curving eyebrows suggest the resemblance to rams' horns which Assyrian images have also The nose is almost Grecian, except that the nostrils are wider, and the chin and lower jaw are the reverse of Indian physiognomy. Only the mouth bears any resemblance to our Indian carving. In this feature there is a slight leaning toward the style of some of the Alaska totem faces On each side above and behind the ear is a protuberance like the fold over the old Egyptian statues, and a claw-like arm extends from the edge of the bowl to the side of the throat, its claws being nearly under the chin of the figure. The hair is not cut in detail. It seems to be in a straight mass, without braiding or ornament. The whole head is well proportioned, and is about full-life size. To me this ancient head has a remarkable fascination and impressiveness.

The spot where these ancient burials were made is worthy of the sacred use the forgotten nations made of it. As I stood there in the March evening, the wind from the great plain brought the faint desert odor of the sage brush and the rushing sound of the turbulent, swollen Umatilla, singing to itself for very loneliness. Before me the grand, noiseless, but irresistible Columbia spread wide, golden in the fiery sunset, and rolling silently and mightily, with boiling, writhing whirls upon its gleaming bosom into the very gate of heaven, it seemed; for at the western horizon where it is lost to view it is a score of miles from the Umatilla, and the low hills are lost in the brightness of the grand sunset light which meets the river at the horizon's verge, and is so wondrously reflected upon its level tide that heaven and earth seem one.—*Oregon and Washington Farmer.*

GEOLOGY.

JURA-TRIAS.

G. C. BROADHEAD.

In 1880 we observed the geological structure around Las Vegas, New Mexico, and in 1881 similar rocks were observed in Southern Wyoming.

Hayden (Colorado and New Mexico, 1869,) speaks of the granites and gneisses of Las Vegas; above these the carboniferous with fifty feet of red sandstone still above and free from fossils which he calls Triassic, and still above he assigns over 300 feet of red and gray sandstone to the Jurassic; from the latter he obtained only a *Mytalus*. Still above this, geologically, is the well known "Hog back" of light colored sandstone assigned by Hayden to No. 1 Cretaceous.

I observed the following: Up the cañon of Gallinas Creek above the Hot Springs, the archæan red granite forming the mountain nucleus arises in bold escarpments for over 500 feet, and still further back reaches still higher in the mountains. Nearer the Springs we find darkly banded gray gneisses.

On the south side of the valley the carboniferous limestones rise up for several hundred feet. Their texture and general appearance and fossils are those of the lower coal measures of Missouri. Among the fossils I observed *Fusulina Cylindrica*, *Chætetes Milleporaceus*, *Lophophyllum proliferum*, *Athysis subtilita*, *Spirifer cameratus*, *Productus longispinus*. Higher up on the mountain side, north, I obtained a fragment of a species of *Lepidodendron* from a coarse sandstone, resembling a species from lower coal measures of southwest Missouri.

Passing down the valley of Gallinas Creek we observe red beds similar to those Hayden describes, but I obtained no fossils. So I would be slow in offering an opinion as to their geological age, but they are certainly of more recent age than those carboniferous rocks above named.

Nearly a half mile below the Springs a beautiful red sandstone very prominently obstructs the course of the stream. This rock affords the fine building stone used extensively at the Springs in constructing the hotel, baths, etc. Passing a half mile or more east of the Springs we ascend the famous "Hogback" formed of nearly white sandstone on edge and almost obstructing the entrance to the valley of the Springs. Eastwardly the rocks gradually become horizontal and are certainly cretaceous. The crest of the "Hogback," for some distance, seems like a marked out road with walls on each side, and from the top a very fine view can be obtained of the valley extending toward the old town of Las Vegas and beyond, as well as Upper Las Vegas and the Atchison, Topeka &

Santa Fe Railroad. The next hill east of the "Hogback" rising nearly 200 feet high, is covered with rounded boulders of rocks resembling those of the Archæan above the Springs.

I observed no fossils in the sandstone forming the "Hogback"; Prof. H. assigns it to No. 1 Cretaceous. The rocks next above and on the east are chiefly dark shales. The sandstone is also well represented along the valley of the Moro on the line of the Atchison, Topeka & Santa Fe Railroad.

It may be that Prof. Hayden has traced these so called Jura-Trias rocks a long distance and found fossils in them.

Before reaching Sherman on the Union Pacific Railroad we observe rocks resembling those of Las Vegas and they are probably of the same age. Approaching Laramie City the Red Buttes are prominent, as are also the red beds to be seen twenty-five miles off to the southwest which I noticed in the August number of the Kansas City REVIEW. I here produce the section therein:

1.— 200 feet White beds on hill-top.
2.—1000 feet of Red beds.
3.— 36 feet of White gypsum.
4.— 100 feet of Red and Gray beds.

In these rocks I observed no fossils. Hayden and most of the U. S. Geologists speak of these red beds occupying a narrow belt east of the mountains and in juxtaposition thereto, extending from north of the Union Pacific Railway southwardly into New Mexico. They also call them Jurassic and Triassic or Jura-Trias, but find no fossils in the Trias east of the mountains, excepting on Gallinas Creek, New Mexico, the Black Hills, mouth of Judith River, heads of Yellowstone, Missouri and Wind Rivers. I give the following as the Bibliography of the Jura-Trias in the western States and Territories:

Prof. Jules Marcon was probably the first who spoke of the existence of the Jurassic and Triassic in western America. From June, 1853, to March 1854, he accompanied Capt. Whipple, U. S. Army, on a tour from Fort Smith, Ark., via Albuquerque, New Mexico, to Los Angeles, California. A portion of his route was reviewed and published in Pacific Railway Reports. His own work is fully detailed in his Geology of North America, Zurich, Switz., 1858. Accompanying this we find a Geological Map of North America on which is colored an extensive area of New Red and also of Jurassic. A considerable area of this has since been referred by American geologists to the Cretaceous. He includes 1500 feet of strata observed on the Llano Estacado as Triassic. This is probably the equivalent of Hayden's Dakotah Group, and may also include part of No. 2 Cretaceous of Hayden. Prof. Marcon speaks of an extensive development of Triassic between Zuni and the Colorado Chiquito inclosing large fossil trees.

Of the rocks of Pyramid Mount (Lat. 35, Long. 103° 58′) in Llano Estacado, he places the lower beds in the New Red, the upper in the Jura. Prof. Marcon informs us that he submitted the fossils to European geologists and palæontologists and they recognized among them *Gryphæa dilatata* and *Ostrea Marshii* and

were therefore Jurassic. Other American geologists assign these rocks to the Cretaceous.

Marcon places the rocks of Pueblo Creek and Zuni River in the Trias. Henry Engelmann, in Simpson's Report, 1859, refers to Meek and Hayden's statement of Jurassic occurring in the Black Hills, and says that he observed indications of similar rocks in the Uinta and Wahsatch. Engelmann relates that he obtained a few Jurassic fossils on North Platte between the Red Buttes and the mountains. These beds were overlaid by certain beds of a purple and gray gypsiferous sandstone which he called Trias. On the east fork of Weber River he obtained *Pecten Ostrea* and *Pentacrinus* which he referred to the Jura. This volume contains one plate and descriptions of Jurassic fossils by Prof. Meek, embracing *Dentalium, subquadrata, Gryphæa calceola, Camptometes bellis mata, Belemnites, Ostrea Engelmanni,* and *Pentacrinus.* These fossils were obtained from Red Butte and the west side of the Wasatch, and Mr. Meek says they are clearly Jurassic.

In 1858 Prof. Meek published in Proc. Ac. Nat. Sc., Philadelphia, sections on Upper Missouri and says that certain beds at the mouth of Judith River lying near the base may be older than the Cretaceous.

Prof. Jno. S. Newberry in Ives' Survey of Colorado River speaks of the occurrence of Jurassic and Triassic in Abajo Mountains in southeastern Utah. Newberry (1859) in Geology from New Mexico to the Grand and the Green, referring to the formation around Santa Fe gives 1500 feet of red beds, noted also at Pecos and San Jose with obscure forms of Walchia and a Calamite.

At Abiquin, New Mexico, Dr. Newberry discovered in the roof-shales thousands of impressions chiefly of cycadeous plants clearly referable to Jurassic, and three plates are devoted to the figures. Dr. Newberry also speaks of Triassic and Jurassic in the Grand Cañon of the Colorado, and also figures certain Triassic fossils from Los Broncos, Sonora.

McFarlane in his Geological Railway Guide, Art. Colorado—Hayden, says Trias or Red Beds occur at Morrison Station sixteen miles from Denver and also at Golden. In the same book, Art. Wyoming, A. Hague speaks of Jurassic and Triassic at Red Buttes, with Jurassic at Como and Triassic at Iron Point and Humboldt, Nevada.

Messrs. Meek and Hayden, in Palæontology of Upper Missouri, 1864, devote sixty-two pages to descriptions of Jurassic fossils with three illustrative plates. Among the fossils *Pantacrinus Astericus* was obtained from opposite Red Buttes and North Platte, and other fossils from Wind River Valley, southwest of Black Hills and Big Horn Mountains. In Geological Report of the Yellowstone and Missouri Rivers, 1859, by F. V. Hayden, of Capt. Raynolds' Exploration, published in 1869, Prof. Hayden says that certain fossils collected, at the head of Wind River valley, Lat. 43° 30′, Long. 110° W., also from Big Horn Mountains, the Black Hills and Red Buttes, present clear affinities to the Jurassic of the Old World. This pamphlet of Hayden's also contains his system of nomenclature of the Cretaceous as well as a geological map of head waters of the Mis-

souri and country north of Ft. Laramie and eastwardly to the Missouri River. Hayden (Colorado and New Mexico, 1859,) speaks of the Triassic and Jurassic at Las Vegas, but he only found a *Mytalus*. In Geological Report, 1874, he refers Glen Eyrie and the Garden of the Gods to the Trias. He also speaks of a narrow belt of Jurassic from the Union Pacific Railway southwardly into New Mexico.

In the same volume Peale describes certain beds of Triassic and Jurassic on the Grand River west of the Rocky Mountains, also on Gunnison River near the mouth of Smith's Fork and on Eagle River. The lower Grand Cañon of the Gunnison has been called Unaweep (meaning red earth) by the Indians. In the same region Peale assigns nearly a 1000 feet overlying the so-called Trias to the age of the Jura—but no fossils.

In Hayden's Report, 1870, Meek gives a list of nine species of Jurassic fossils from Henry's Fork of Green River, Red Buttes, Salinas and Como. In Hayden's Report, 1872, Cinnabar Mountain on the Yellowstone is made to include certain strata with Jurassic fossils. Jurassic is also stated to occur on Gallatin River and at the three forks of the Missouri Peale in the same volume gives a section at the head of the Gallatin including Cretaceous, Jurassic, Triassic and Carboniferous and names four fossils as being certainly Jurassic. In this volume Prof. Meek gives a catalogue of twenty-two species of Jurassic from near the cañon of the Yellowstone; eleven species from Spring Creek, Montana; seven from Ft. Hall, Idaho, and eight from Cinnabar Mountain.

In Hayden's Report, 1873, Marvin gives sections of Jurassic near Bear's Creek, Big Thompson, near St. Vrain's, etc., but mentions no fossils.

Hayden's Report, 1875: Peale describes the Jurassic and Triassic of Gunnison and Grand Rivers, and furnishes comparative sections from Powell, Newberry, Gilbert and Howell. Howell's section includes four species of Jurassic fossils from southern Utah with 2000 feet of Jurassic rocks. He also indicates Trias at same place. Powell has over 5000 feet of Jurassic and Trias from plateau of southern Utah, and Gilbert has 1800 feet of Trias from Ft. Wingate, New Mexico.

Hayden's Report, 1876: White speaks of the overlying Jurassic as soft, greenish, and reddish and purple sandstone beds with sandy calcareous shales. He refers to fossils collected by Major Powell in southern Utah which he regards as Triassic, and that the relative position of the shales justifies their reference to the Trias but the invertebrate fossils point to a Jurassic age. He therefore calls the beds Jura-Trias. Endlich, in the same volume, says that all along the Front Range the Trias is prominent, disappearing toward the south. Peale also speaks here of the Juras-Trias on Grand River.

In Hayden's Report, 1877, Peale gives section of Jura-Trias in southeastern Idaho and western Wyoming, 2500 feet of Jurassic and 3000 feet of Triassic. The fossils are described by White in Bulletin of Survey, Vol. V, No. 1, and include quite a list of fossils: *Crinoideæ*, *Cephalopoda* and *Acephala*, etc. Peale also, in same Bulletin, enumerates over twenty species from Jura-Trias of southeastern

Idaho and western Wyoming and gives 1500 feet of Jura, the upper 700 feet gray shales and green sandstone; the lower 800 feet of limestone and shale, below which he describes 4000 feet of Trias chiefly red with some calcareous beds with some fossils in the lower part.

In Hayden's Report, 1878, Dr. White has a special Report on Palæontology published in 1880, including two plates of Jurassic and two plates of Triassic fossils. In this he speaks of the Jurassic of southern Utah and says the Triassic is not recognized by fossils east of the Rocky Mountains.

In Palæontology of California, Meek devotes eleven pages and two plates to Jurassic fossils, and Gabb has sixteen pages and four plates of Triassic.

In Jones' Report on Northwestern Wyoming and Yellowstone Park, 1875, Prof. Comstock names the red beds of Deep Creek, Wind River Mountains, and calls them Triassic, but says they are devoid of fossils. Over them he found 1000 feet of Jurassic including eight species of fossils.

In Ludlow's Report of Reconnoissance of the Yellowstone Park, 1875, three species of Jurassic fossils are figured and described by R. P. Whitfield. These were obtained from Bridger Mountains, Montana, on East Gallatin River. Mr. E. S. Dana in the Geological Report mentions finding seven species of fossils. In Report on Palæontology of the Black Hills, 1880, Prof. R. P. Whitfield has four plates of Jurassic fossils, the specimens obtained from the Black Hills and Big Horn Mountains. In Bulletin U. S. Geological Survey, 1876, Vol. II, No. 3, Hayden gives a section at head waters of the Missouri and Yellowstone showing Jurassic overlying the Carboniferous of Gallatin River.

In Bulletin, Vol. III, No. 3, 1877, White speaks of the Jurassic of the Rocky Mountains.

King in the Geological Report of the 40th Parallel devotes forty-six pages to the Jurassic and Triassic. He refers to their occurrence on Big Thompson River, on the Chugwater and Brush Creeks. Near the line of Colorado and Wyoming, southwest of Laramie, Mr. King gives 1200 feet of red beds. King mentions the occurrence of Trias in the Uinta range, on Yampa plateau, on Du Chesne Creek. He speaks of the occurrence of *Pentacrinus Astericus* near the base of the Jura. In the Western Humboldt range he speaks of a limestone with distinct Jurassic fossils which have been described by Meek and Gabb. King estimates the Humboldt Jurassic to be 15 to 17000 feet thick. King enumerates four species of Jurassic fossils from Como Station, Union Pacific Railway; five species from Rawlings Peak in beds below the cretaceous Dakotah. In the Uinta Range a number of fossils have been obtained from the Flaming Gorge. King in Vol. IV, 40th Parallel Survey, devotes two plates to Triassic fossils and one to Jurassic. The fossils are identified and described by R. P. Whitfield, and are from Wyoming, Utah and Nevada, chiefly from Augusta Mountains, Nevada, and Flaming Gorge, Uinta Range. The Triassic from the Wahsatch and Humboldt are identified by Meek.

In Vol. II, of 40th Parallel Survey by Emmons and Hague, considerable space is devoted to the discussion of the Jurassic including strata of the Uinta

Mountains, Augusta Mountains, Black Butte, Como, Eastern Foothills, Eugene Mountains, Flaming Gorge, Pah-Ute, Range, Laramie Valley, West Humboldt, Montezuma Range, Wahsatch, Yampa River, etc. The generalized section also includes Jurassic and Triassic beds, and Trias also occurs at nearly all the above named localities. In Geological Report, West of 100th Meridian of Wheeler, Prof. Stevenson speaks of Trias in Animas Park and says that in Colorado the group shows no fossils and no clue can be given to its age except from the stratigraphical relation to the Jurassic and Cretaceous. He describes the rocks at Cañon City and Colorado Springs.

In Vol. III, Supplement to Wheeler's Report, Prof. J. J. Stevenson devotes a short chapter to the Jura-Trias, to which he refers certain beds in northern New Mexico between the Carboniferous and the Dakotah Cretaceous, but saw no fossils. In Vol. IV, Report West of 100th Meridian, Dr. White says that none of the invertebrate fossils of the collection are properly referable to the Triassic, but in the collection he refers eight pieces to the Jurassic which were collected at widely separated localities in Nevada and Utah. They include one crinoid (*Pentacrinus Astericus*) mentioned also in King's Report, and mollusca. Cope in the same volume speaks of Triassic and Jurassic in New Mexico on Gallinas Creek, including *Dinosauria* and *Crocodilia*, with five species of Unios described by Meek.

In Powell's Survey of the Rocky Mountain Region, G. K. Gilbert, in the Geology of the Henry Mountains, says that the sedimentary rocks in that region range from the summit of the Cretaceous to the summit of the Carboniferous, and refers 2930 feet to the Jura-Trias—lying between the Carboniferous and Cretaceous, and represented by sandstones with shales, colors, purple, red, white and buff. Powell, in Geology of the Uinta Mountains, 1878, includes 1200 feet in Flaming Gorge as Jurassic and 4000 feet of Triassic.

Dana in his Manual of Geology, 1874, says that the Triassic has been identified by fossils in British Columbia, and that Upper Trias occurs at entrance of Pavalonk Bay, Alaska, and are by Whitney referred to the Middle Kenper of Europe.

We now turn to the Geological Survey of Canada. In Report, 1872–3, Principal J. W. Dawson assigns certain coniferous woods from Nawaimo, Vancouver's Island, to the Mesozoic age ranging from Jurassic to Upper Cretaceous. A plant to which he applies the name *Cycadeocarpus* he says is from the Lower Cretaceous or Jurassic of Skidegate, Queen Charlotte Island. Mr. Jas. Richardson same volume gives a section and says the fossils of certain beds are partly Jurassic and partly Cretaceous.

In Geological Survey, Canada, 1875–76, Mr. J. F. Whiteaves gives descriptions of two Jurassic fossils and one Triassic fossil from Peace River, British America.

In Canada Geological Survey, 1876–77, Mr. J. F. Whiteaves describes Jurassic fossils from the Coast Range of British Columbia, including twenty-seven species of Mollusca and one of Annelida.

In Canada Geological Survey, 1887-78, Mr. G. M. Dawson intimates the occurrence of Triassic rocks in British Columbia, but he is not specially descriptive.

In Canada Geological Report, 1878-79, Mr. G. M. Dawson discusses the Triassic of Queen Charlotte Islands, including 500 feet on the shores of Houston Stewart Channel, including eight species of fossils synchronous with the so-called Alpine Trias of Nevada. Other fossils are from Rose Harbor and Copper Islands and Burnaby Strait. Prof. Dawson estimates that the overlying volcanic rocks in the neighborhood of Logan Inlet, Island of Moresby, cannot be less than 5000 or 6000 feet.

The above is an epitome of Jura-Trias for Western America. Fuller information can be obtained from the books referred to and I hope it may assist those who desire to examine the localities referred to. I was glad to see the article of my friend Hallowell in the December number of the REVIEW and hope to hear from him again.

PLEASANT HILL, MO., Dec. 1882.

THE DEVIL'S PIT.

REV. JOHN D. PARKER, U. S. A.

In Crockett county, Texas, on the divide between Devil's River and the Nueces, there is a cavern in the rocks that has been named the Devil's Pit. The divide at this point is perhaps a thousand feet above the level of the river. The cavern in the ground is about eighteen feet across at the top, and has the form of an inverted perpendicular cone, being several hundred feet across at the bottom. Perhaps a hundred men have gone to the cavern with the purpose of being let down into it, but concluded when they saw it that some one else might have the glory of exploring it. Recently a man was found who had the nerve to see if the cavern was rightly named. As he passed down by a rope held firmly above, he found the bees had made their hives in the sides of the rock. He declared there were tons of honey in the cavern. If the air had not been rather cold he could not have gone down without being stung. About ninety feet down he found a small live oak tree growing on the side of the cavern, the roots fast in the rocks.

When he had been let down one hundred and eighty feet he came to the top of a mountain of rock in the shape of a solid cone—a cone within a hollow inverted cone—with plenty of room between them to explore the cavern. So he let go of the rope and went down the sides of this mountain about a hundred feet, when he came to a lake of water. This water appeared to be deep, but he had no means of measuring its depth. A canteen was let down to him, which he filled and brought up. The water was clear and agreeable to the taste. On the outside down the hill the water seeps out of the rocks, and people now think it is the outlet of the lake in the cavern. Whether the water has gathered in the

cave from the orifice at the top, or a stream flows under ground, it is impossible to determine with the present limited observations.

This cavern is situated about ten miles east from Judge M. D. Kent's sheep ranch, and about forty miles northeast of Fort Clark. This is a very wild region, with few inhabitants. Recently a panther was killed in this vicinity which measured from tip to tip thirteen feet. This is the sixth panther that has been killed in this vicinity within a few months. The Mexican lion, or cougar, is also found in this region, and in the jungles of the Rio Grande is found the leopard cat.

It has not been determined whether the cavern is the result of erosion from running water, or was formed by volcanic action. Nothing can be known about it scientifically without an examination by a competent geologist. Texas is full of interest to the scientist, but almost nothing has been done in this direction. There are probably rich mines of coal, silver, lead and tin, and perhaps other metals. The State has a full treasury, and all it needs is a wise direction given to produce results which would return many times their cost. The flora and fauna are especially rich. Taxidermists are frequently sent here to enrich the collections of eastern institutions.

CORRESPONDENCE.

SCIENCE LETTER FROM PARIS.

PARIS, December 18, 1882.

SANITARY CONDITION OF EUROPEAN CITIES—THE COMET AND PLANETS, ETC.

The question of questions at the present moment for citizens is that of the typhoid fever endemic. The Academy of Sciences is of late wholly occupied with that subject, which comes home to the business and bosoms of every resident. Paris may be the most beautiful of capitals, but it is beyond doubt next to the most insalubrious. It has more than the commencement of an admirable system of sewers, but their efficacy is checked by the absence of water for flushing; hence, in summer, but particularly in autumn, the kennel-mouths of the sewers are so many pestilence pipes, as every passer-by but too well knows. Insufficiency of water for flushing purposes in houses as well as in the branch and main sewers; uncleanly-kept premises; overcrowded habitations; inadequacy of water for domestic wants, and even that supply derived from infected rather than impure sources—such are conditions for the plague.

Dr. De Murry is convinced, the source of typhoid fever, as of cholera, lies in the dejections of the patients; hence, the water-closets become the nursery ground for the malady. One ill-kept closet on any story is sufficient to poison the entire household. He has but a relative confidence in the statistics of mor-

tality; only those can be relied upon which originate from hospital records; the information furnished by private practitioners is neither precise nor complete.

Dr. Rochard, a most eminent navy surgeon, positively dissects the sanitary condition of Paris. His demonstrations, mathematically correct, are not at all encouraging even to the robust. Uncleanliness and overcrowding are for Dr. Rochard the causes of typhoid fever The barracks illustrate at once the bane and the antidote: The buildings and out offices are offensive in point of hygiene; there is an absence of ventilation; the men live packed together. An outbreak of fever follows, as a matter of course. The men are ordered to live under tents. A fortnight elapses, during which the barracks are flushed, aërated, purified; the men return, but in fewer numbers, and the malady does not reappear. Similarly on board ship, when continued rough weather compels hatches and windows to be closed, and passengers to remain below, fever will soon break out, because the germs of the disease were in the air, and only waiting the conditions for their development—their atmospheric fertilizer. Since 1869, typhoid fever, small-pox and diphtheria are permanently on the increase here. Taking the two epochs 1869-1873, and 1879-1881, the victims for every 1,000 inhabitants have been respectively:—for fever, 48 and 96 victims; diphtheria, 54 and 101; small-pox, 19 and 74. This is the more strange, as while the fever augments at the rate of 100 per cent in Paris, the per centage diminishes in every other country. The hospital returns attest one decease for every fifteen patients down with typhus. It is curious, while not the less remaining a truth, that this increase of fever has followed the augmentation of the population. The occupants of furnished lodgings, etc., have more than doubled; where only four were formerly accommodated, now the same space is allocated to ten and fifteen persons. And these lodging-houses progress in uncleanliness as the tenants increase.

In a few of the grand arteries of Paris the construction of the sewers, etc., is magnificent; but visit the upper and the older quarters of the city, and there the sewage system will appear in all its primitive simplicity and horror. A continued bed of black, putrid detritus, through which meanders a thread of water, insufficient to flush, but adequate to propagate pest. The supply of water is 400,000 cubic yards for a population of 2,000,000, and even when the promised 150,000 cubic yards additional are provided, the supply will be still inadequate. The drinking-water is mixed with that specially conveyed and that of the Seine. Now the latter receives beforehand the waste-water from the great night-soil depot, as well as the dejections from suburban villages representing a collective population of 120,000 souls! Further, Paris is surrounded by a belt of insalubrious establishments; there are 305 chemical works authoritatively pronounced deleterious and dangerous from their emanations, unhappily too readily recognized; there are also 25 *depotoirs* for working up the night-soil, in addition to the others which receive daily 2,000 tons of household refuse—there being no dust bins attached to Paris houses, instead we have horrible night-soil reservoirs—emptied every morning into the street to be carted away, and shot down outside the fortifications.

Brussels is a model in this respect for Paris and perhaps for other cities also.

There every practitioner on recognizing a patient attacked with fever is bound to advise the Health Office, which at once sends its inspector to report on the situation, with summary powers t arry the patient to the hospital; to disinfect the apartment occupied, the bed, clothing, apparel, etc.; to examine the sewage, cleanliness of the premises, etc., and to remedy, on the moment, all defects, making the proprietor pay if his responsibility be proved. And the result? A diminution of 100 per cent in the deaths from zymotic diseases. Up to the present it was concluded that a dry season was favorable to an outbreak of typhus. Never had an autumn been wetter than the present, and never was the disease more prevalent. In some of the city barracks the occupants of one wing of the building only were attacked; in the case of another barracks, the cavalry alone suffered. The Sanitary Committee of the municipality in its instructions suggest that the patients be placed in the middle of the room, and the members of the family kept away; that disinfectants be employed, etc. But the fever has its home in families that have but one room, and not a farthing to buy medicine or food, let alone disinfectants. The 250,000 night-soil reservoirs, as already alluded to, and which are presumed to be "hermetically closed" till emptied once or twice a year, until superseded by some other plan, must remain a permanent nursery for the seeds of infectious diseases.

The early-morn comet that has been our visitor so long, has given birth to a daughter, as M. Schmidt, of Athens, has discovered. One morning a little comet was observed running alongside the big one—the mother. The little stranger has been produced by segmentation; the two stars have the appearance to march together, but the mother has changed in form; the noyau from being spherical has become elongated. It is not the first occasion that our world has witnessed the birth of a star. The Biela comet in 1846 split into two. Discovered in 1826 by Biela, it returned later, in six years and nine months, as was accurately predicted. On the 13th of January, 1846, it opened in two, lengthways, and that evening the twins traveled in beauty side by side—two complete comets with independent heads and tails. A few days later they separated, and by the 10th of February they were already 180,000 miles asunder. One lost its tail rapidly and also its brilliancy; by March both were invisible. In 1852, after a punctual revolution of six years and nine months, they reappeared, but distant 1,500,000 miles from each other. Since, nothing has been heard of either. However, it is suspected that the showers of falling stars that so signally marked the year 1872 were the debris of the Biela comets. According to Schiaparelli a swarm of shooting stars follow in space orbits identical with comets, and are simply comets reduced to morsels by disintegration.

Other celestial curiosity, the planets Mars and Venus, are those that have the greatest degree of relationship with our earth. All planets would seem to pass through the same series of transformations, their actual differences being due to their state of evolution. Thus Venus would be almost akin, in point of evolution, to the earth; while, on the contrary, Mars would be more advanced. Spec-

tral analyses have, within certain limits, confirmed these hypothetical views. Following the observations of M. Schiaparelli, the surface of Mars has become much modified since three years. Large shady spaces had hitherto been observed, and concluded to be oceans; now dark surfaces have become bright, and *vice versa*. These differences in light and shade may imply modifications in the distribution of waters, or variations in vegetation. Stranger still, a number of dark lines traverse the continent of Mars, and connect two distant dark spots. From the mathematical arrangement of the dark lines, imagination conceives them to be canals uniting oceans; but what is puzzling, these lines at certain epochs become double, in the sense of becoming parallel. There are these second canals, alongside one another, that makes us doubt what uses the engineers in Mars can destine them for. More likely the phenomena are due to the geographical construction of the planet—the effect of the shadows of ravines.

Messrs. Chatriau & Jacobs have made the owners of diamonds tranquil; white diamonds sell at about 30,000 f. per ounce; if yellow, at eight times less. A diamond merchant having purchased a white diamond, was surprised on washing his hands in soap-water to find the stone in his ring turn yellow. This, as M. Chevreiul shows, was due to "complementary," or associated colors, by which union a diffent shade is produced. But the new color is ephemeral—a little rubbing will restore the pristine hue. White diamonds will ever retain their purity, but as yellow can also be made temporarily white, caution is necessary in purchasing. F. C.

PHILOSOPHY.

OUR ORIGIN AS A SPECIES.

RICHARD OWEN, C.B., F.R.S.

There seems to be a manifest desire in some quarters to anticipate the looked for and, by some, hoped-for proofs of our descent, or rather ascent, from the ape.

In the September issue of the *Fortnightly Review* a writer cites, in this relation, the "Neanderthal skull, which possesses large bosses on the forehead, strikingly suggestive of those which give the gorilla its peculiarly fierce appearance;" and he proceeds: "No other human skull presents so utterly bestial a type as the Neanderthal fragment. If one cuts a female gorilla-skull in the same fashion, the resemblance is truly astonishing, and we may say that the only human feature in the skull is its size."[1]

In testing the question as between Linnæus and Cuvier of the zoölogical

1. Grant Allen, "On Primitive Man," p. 314.

value of the differences between lowest man and highest ape, a naturalist would not limit his comparison of a portion of the human skull with the corresponding one of a female ape, but would extend it to the young or immature gorilla, and also to the adult male; he would then find the generic and specific characters summed up, so far, at least, as a portion or "fragment" of the skull might show them. What is posed as the "Neanderthal skull" is the roof of the brain case, or "calvarium" of the anatomist, including the pent-house overhanging the eye-holes or "orbits." There is no other part of the fragment which can be supposed to be meant by the "large bosses" of the above quotation. And, on this assumption, I have to state that the super-orbital ridge in the calvarium in question is but little more prominent than in certain human skulls of both higher and lower races, and of both the existing and cave-dwelling periods. It is a variable cranial character, by no means indicative of race, but rather of sex.

Limiting the comparison to that on which the writer quoted bases his conclusions—apparently the superficial extent of the roof-plate—its greater extent as compared with that of the gorilla equaling, probably, in weight the entire frame of the individual from the Neanderthal cave, is strongly significant of the superiority of size of brain in the cave-dweller. The inner surface moreover indicates the more complex character of the soft organ on which it was moulded; the precious "gray substance" being multiplied by certain convolutions which are absent in the apes. But there is another surface which the unbiased zoölogist finds it requisite to compare. In the human "calvarium" in question, the mid-line traced backward from the superorbital ridge runs along a smooth track. In the gorilla a ridge is raised from along the major part of that tract to increase the surface giving attachment to the biting muscles. Such ridge in this position varies only in height in the female and the male adult ape, as the specimens in the British Museum demonstrate. In the Neanderthal individual, as in the rest of mankind, the corresponding muscles do not extend their origins to the upper surface of the cranium, but stop short at the sides forming the inner wall or boundary of what are called the "temples," defined by Johnson as the "upper part of the sides of the head," whence our "biting muscles" are called "temporal," as the side-bones of the skull to which they are attached are also the "temporal bones." In the superficial comparison to which Mr. Grant Allen has restricted himself in bearing testimony on a question which perhaps affects our fellow-creatures, in the right sense of the term, more warmly than any other in human and comparative anatomy, the obvious difference just pointed out ought not to have been passed over. It was the more incumbent on one pronouncing on the paramount problem, because the "sagittal ridge in the gorilla," as in the orang, relates to and signifies the dental character which differentiates all *Quadrumana* from all *Bimana* that have ever come under the ken of the biologist. And this ridge much more "strikingly suggests" the fierceness of the powerful brute-ape than the part referred to as "large bosses." Frontal prominences, more truly so termed, are even better developed in peaceful, timid, graminivorous quadrupeds than in the skulls of man or of ape. But before noticing the evi-

dence which the teeth bear on the physical relations of man to brute, I would premise that the comparison must not be limited to a part or "fragment" of the bony frame, but to its totality, as relating to the modes and faculties of locomotion.

Beginning with the skull—and, indeed, for present aim, limiting myself thereto,—I have found that a vertical longitudinal section brings to light in greatest number and of truest value the differential characters between lowest *Homo* and highest *Simia*. Those truly and indifferently interested in the question may not think it unworthy their time—if it has not already been so bestowed—to give attention to the detailed discussions and illustrations of the characters in question in the second and third volumes of the "Transactions of the Zoölogical Society."[2] The concluding memoir, relating more especially to points of approximation in cranial and dental structure of the highest *Quadrumane* to the lowest *Bimane*, has been separately published.

I selected from the large and instruction series of human skulls of various races in the Museum of the Royal College of Surgeons that which was the lowest, and might be called most bestial, in its cranial and dental characters. It was from an adult of that human family of which the life-characters are chiefly but truly and suggestively defined in the narrative of Cook's first voyage in the Endeavor.[3]

Not to trespass further on my readers, I may refer to the "Memoir on the Gorilla," 4to, 1865. Plate XII gives a view, natural size, of the vertical and longitudinal section of an Australian skull; plate XI gives a similar view of the skull of the gorilla. Reduced copies of these views may be found at p. 572, figs. 395, 396, Vol. II, of my "Anatomy of Vertebrates."

As far as my experience has reached, there is no skull displaying the characters of a quadrumanous species, as that series descends from the gorilla and chimpanzee to the baboon, which exhibits differences, osteal or dental, on which specific and generic distinctions are founded, so great, so marked, as are to be seen, and have been above illustrated, in the comparison of the highest ape with with the lowest man.

The modification of man's upper limbs for the endless variety, nicety and perfection of their application, in fulfillment of the behests of his correspondingly developed brain—actions summed up in the term "manipulation"—testify as strongly to the same conclusion. The corresponding degree of modification of the human lower limbs, to which he owes his upright attitude, relieving the manual instruments from all share in station and terrestrial locomotion—combine and concur in raising the group so characterized above and beyond the apes, to, at least, ordinal distinction. The dental characters of mankind bear like testimony. The lowest (melanian), like the highest (Caucasian), variety of the bimanal order

2 "Osteological Contributions to the Natural History of the Orangs (*Pithecus*) and Chimpanzees (*Troglodites niger* and *Trog. gorilla.*)"

3 Hawkesworth's 4th ed., Vol. III, 1770, pp. 86, 137, 229. The skull in question is No. 5,791 of the "Catalogue of the Osteology" in the above Museum, 4to, Vol. II, p. 823, 1853.

differs from the quadrumanal one in the order of appearance, and succession to the first set of teeth, of the second or "permanent" set. The foremost incisor and foremost molar are the earliest to appear in that series; the intermediate teeth are acquired sooner than those behind the foremost molar.[4]

In the gorilla and chimpanzee, the rate of course of progress is reversed; the second true molar, or the one behind the first, makes its appearance before the bicuspid molars rise in front of the first; and the third or last of the molars behind the first comes into place before the canine tooth has risen. This tooth, indeed, which occupies part of the interval between the foremost incisor and foremost molar, is the last of the permanent set of teeth to be fully developed in the *Quadrumana;* especially in those which, in their order, rank next to the *Bimana.* To this differential character add the breaks in the dental series necessitated for the reception of the crowns of the huge canines when the gorilla or chimpanzee shuts its mouth.

But the superior value of developmental over adult anatomical characters in such questions as the present is too well known in the actual phase of biology to need comment.

In the article on "Primeval Man," the author states that the Cave-men "probably had lower foreheads, with high bosses like the Neanderthal skull, and big canine teeth like the Naulette jaw."[5]

The human lower jaw so defined, from a Belgian cave, which I have carefully examined, gives no evidence of a canine tooth of a size indicative of one in the upper jaw necessitating such vacancy in the lower series of teeth which the apes present. There is no such vacancy nor any evidence of a "big canine tooth" in that cave specimen. And, with respect to cave-specimens in general, the zoölogical characters of the race of men they represent must be founded on the rule, not on an exception, to their cranial features. Those which I obtained from the cavern at Bruniquel, and which are now exhibited in the Museum of Natural History, were disinterred under circumstances more satisfactorily determining their contemporaneity with the extinct quadrupeds those cave-men killed and devoured than in any other spelæan retreat which I have explored. They show neither "lower foreheads" nor "higher bosses" than do the skulls of existing races of mankind.

Present evidence concurs in concluding that the modes of life and grades of thought of the men who have left evidences of their existence at the earliest periods hitherto discovered and determined, were such as are now observable in "savages," or the human races which are commonly so called.

The industry and pains now devoted to the determination of the physical characters of such races, to their ways of living, their tools and weapons, and to the relations of their dermal, osteal, and dental modifications to those of the mammals which follow next after *Bimana* in the descensive series of mammalian orders, are exemplary.

4 "Odontography," 4to., 1840-41, p. 454, plates 117, 118, 119.

5 *Fortnightly Review,* September, p. 321.

The present phase of the quest may be far from the bourn to yield hereafter trustworthy evidence of the origin of man; but, meanwhile, exaggerations and misstatements of acquired grounds ought especially to be avoided.—*Longman's Magazine.*

IS EVOLUTION GODLESS?

This important question has sometimes been hastily or ignorantly answered in the affirmative. How it is answered by a master of the subject, who accepts the great truths of Christianity as fully as he does the doctrine of evolution, and who can give a reason for both the scientific and the theological faith that is in him, may be seen from the following abstract of Dr. Winchell's lecture on the question:

The religious nature of man has always manifested a tendency to revolt against any general theory of development in the processes of the world. Such doctrines have been equally opposed among the Greeks, among the religious minds of the Middle Ages, and in our own times. They have never commanded any general assent even among the purely scientific, until within less than a quarter of a century. Since Charles Darwin pointed out, in 1858, the existence of tendencies in the organic world which would go far to explain the means by which transmutations of species may be effected, thinking minds have generally been led to the belief that evolution is the method of nature, and the protests of the religious sentiments have not been able to stay the progress of opinion.

These protests, it must be particularly observed, are based on the supposition that a method of evolution must be a method of self-evolution. With this understanding religious opposition is inevitable and is right. The religious nature is an original and ineradicable constituent of humanity, and has the same right to exercise as the intellect itself. It means more. The objects toward which its activities are directed must be recognized as realities. They are ultimate truths, as valid as the intuitions of reason. A spontaneous evolution robs these faculties of their object, and they protest. It falsifies an affirmation of the fundamental authority of our being, and must be *an impossibility.*

But such an interpretation of evolution is unnecessary. It cannot be defended. The doctrine of evolution is simply a statement of *fact* concerning the *method* of the succession of events in the natural world. In affirms nothing respecting any efficient connection between the successive terms of the series. It affirms nothing respecting the mode of origination of the first term of the series. It says nothing of beginning, but only of the *mode of continuance.* It is entirely compatible with the supposition that the first term was the product of immediate creation.

But scientific writers speak of causes. They tell us that such and such modifications of structure are produced by such and such conditions or antecedents. How is such language to be reconciled with the statement that evolution has nothing

to say about causation? It is important to be borne in mind that the word *cause* is employed in literature in two senses. By cause the scientist means only a uniform antecedent. But every one immediately understands that mere antecedence is insufficient. Some *efficiency* must be exerted in the preceding term which passes over into the following term. There must be a bond connecting the two which is more than simple successiveness. This is is the other conception of cause. This is the conception of real and only cause. The scientific conception of cause is merely that of uniform antecedence among material phenomena, and is therefore not a conception of true efficient causation at all.

Now, all real efficiency originates in *will*. Our own experiences teach that every result attained in the realm of human activities proceeds from human volition. Tools, machinery, the elements of nature,—these are only intermedia which will employs for the accomplishment of its ends. All the eminent authorities concur that the same conclusion must be applied to events in the natural world. All its phenomena are the products of some causal volition.

But the mere fact of volitional causation implies much more. The exercise of will implies a real being, possessing such an attribute. The effects to be produced must be first conceived or apprehended. This is an act of intelligence. The suitable conditions must be chosen; appropriate instrumentalities selected. These are other acts of intelligence. The premeditated effect must be desired; there must be a motive for producing it. Motive and desire belong to the emotional nature. Finally, the exertion of will for the effectuation of the result completes the circle of attributes constituting personality,—that is, separate, self-sustained existence. Intellect, sensibility, and will are the three moments of our own personal being.

Now, to apply this analysis to the organic changes which sometimes take place in animals and plants, we must keep clearly before the attention the discrimination between the *fact* of an evolutionary mode of succession, the *conditions* under which it is effected, the *instrumentalities* employed in the effectuation, and the *cause* whose efficiency employs the iustrumentalities under the conditions to make a given effect a fact of nature. It is plain that when an animal comes into the possession of a modified structure that structure has grown. The result has been attained through the action of the growing forces. A denser covering of fur may have come into existence in connection with the advent of a colder climate. The change in the climate is the *condition* to which the organism becomes adapted, and the changed action of the vital forces produces the adaptation. But the physiological activities within the animal are themselves only instrumental. They are merely physical activities directed to certain ends. They do a work not planned by the organs. These facts point to the existence of some real cause yet undiscovered. It must be an immaterial cause, since the deepest scrutiny of our microscopes discloses only matter engaged in the physical activities just referred to. It must be an intelligent cause, since it selects and builds according to intelligible plans. Only intellect performs such works. Manifestly, then, some intelligent and immaterial cause employs the physiological forces to build the or-

ganism according to certain methods, into such growths as shall be best suited to the external conditions under which the animal lives.

The theological deductions from such a scientific conclusion follow immediately. There must be a first cause. The immaterial cause operative in nature must act *constantly*, not periodically. The world was not created in some beginning, and set running like a clock. Sustaining power is imminent in the world. This view is maintained by eminent authorities in science and philosophy. The cause of the world is possessed of attributes co extensive with the origination and maintenance of the visible universe. This to us means a body of infinite attributes. But the metaphysical infinity of the first cause is reflected in our necessary intuition of the infinite.

Thus evolution is a world embracing plan expressive of mind. It lifts us to the highest possible apprehension of the wisdom and power and unity of the Supreme being, and brings into the most intimate relations with the Father of All in all the phenomena of the natural world, and all the experiences of our daily lives.—*Boston Journal of Chemistry.*

VELOCITY OF PROJECTILES.

It is most unfortunate that none of the ships at Alexandria are armed with guns of the new type. If there were in the fleet even a few of the new 8-inch or 9-inch guns, the ships possessing them could lie completely out of danger from the Aboukir forts, and destroy them by a long range fire without giving them a chance. Something of this sort actually happened in the Chili and Peruvian war. A single new 8-inch Armstrong gun was placed on board a common steamer called a "pig-boat," and bombarded at its leisure the Peruvian forts on shore. The Peruvians sent out a gunboat to come to closer quarters with its ridiculous antagonist. Three shots from the 8-inch Armstrong were, however, sufficient to dispose of the gunboat. The first was short, the second over, the third got the right range, so that the shell fell on deck. The gunboat literally disappeared in a moment, being blown up by the one shell which struck her. Such is the advantage of having guns which impart a very high velocity to their projectiles. All the new English guns give muzzle velocities of about 2,000 feet per second, and this is 400 feet more than that of the 80-ton gun, 640 feet more than the Egyptian 10-inch gun, and 580 feet more than the 9-inch. Though we place the velocity of the new type guns at 2,000 feet, most of them give a velocity considerably higher. For instance, the 12-inch 43-ton gun has already given a velocity of 2,178 feet.

ZOOLOGY AND BOTANY.

NOTES ON THE DISTRIBUTION OF SHELLS, NO. III.

F. A. SAMPSON, SEDALIA, MO.

At one time I thought I had made a full list of the shells found near Sedalia, but having at different times, even down to the writing of this article, made additions to the list, I would not claim that I now give all. For a time after commencing to collect, I was unsuccessful in finding the small shells, and wrote to a friend that there were none in the county. He insisted that there were, and gave some directions about how to hunt for them, after which I soon learned how to find them, and at all suitable stations I now obtain several species, though none of them are common to all stations which appear to be equally suited to them. Of the three *zonites* which are most abundant, *arboreus*, *viridulus* and *indentatus*, some one is generally plenty to the almost or wholly total exclusion of the other two.

The following will be of interest as showing the association of species, the comparative number, as well as the actual number of each found in a search of about one hour at each place. The first locality is in and close to an abandoned stone-quarry a mile northwest of the city. It is surrounded by brush, but no heavy woods and is close by a small stream of water. The shells were all found under stones. The second is southwest of Sedalia in the bottom on Flat Creek, in an open place in the woods. There being no rocks at this place the shells were obtained under logs and sticks. No shells were found in the woods where dense, but in an open space where the most of the timber had been cut down and grass had grown up:

LOCALITY.	NO. 1.	NO. 2.	LOCALITY.	NO. 1.	NO. 2.
Zonites indentatus	25	0	*P. contracta*	5	25
Z. viridulus	2	0	*P. rupicola*	20	0
Z. arboreus	0	120	*P. pentodon*	5	2
Z. minusculus	5	0	*Stenotrema leaii*	6	1
Helicodiscus lineatus	8	0	*Vallonia labyrinthica*	1	4
Pupa armifera	37	18			

The following list gives all that are now known to be in the county, but from the fact that some have been found but at a single place, and at a single time, we may expect further search to bring others to light:

1. *Macrocyclus concava*, Say.—But few specimens have been found and those are either of small size or else they are not full grown.

2. *Zonites arboreus*, Say.—In some localities this is found in large numbers to the exclusion almost of the two following species, while in other places one or both of them takes its place. Generally one of the three largely predominates and but one of the other two is found with it.

3. *Zonites viridulus*, Menke.—In numbers almost equal to the preceding.

4. *Zonites indentatus*, Say.—Not so plenty as either of the two preceding, though I have found it in one locality, at least, the prevailing one of the three.

5. *Zonites minusculus*, Binney.—Not plenty but common in the different localities.

6. *Zonites ligerus*, Say.—Not common or plenty.

7. *Zonites pulvus*, Drap.—Found on bark on the underside of lying logs, but in small numbers.

8. *Helicodiscus lineata*. Say.—Common but not plenty.

9. *Limax campestris*, Binney.—Plenty in woods and open pastures.

10. *Patula solitaria*, Say.—Found on the sides of bluffs, the size being about one half that of the same species from Indiana.

11. *Patula alternata*, Say.—In some places in considerable numbers, and in size smaller than those from Indiana, but there is not so much difference as in the preceding.

12. *Strobila labyrinthica*, Say.—Not plenty, and generally found in same place as *Zonites fulvus*.

13. *Stenotrema hirsuta*, Say.—Not plenty.

14. *Stenotrema leaii*, Ward.—This fine little shell is quite common, being found not only close to timber, but sometimes extending along fence rows into the open fields.

15. *Triodopsis inflecta*, Say.—Specimens in woods on higher land, in small numbers, somewhat smaller than those from Indiana.

16. *Mesodon albolabris*, Say.—A variety which is almost identical with specimens of this species found at Eureka Springs, Arkansas, of which Prof. Wetherby says:

"Specimens of the average size have the spire very much depressed, the aperture correspondingly elongated transversely, and the surface very highly polished. The reflection of the peristome is much narrower, so rendered by its being somewhat folded. It is a very distinct variety, which I have not before seen."

It is quite rare here.

17.—*Mesodon elevata*, Say.—Specimens cannot be distinguished from the Indiana ones. Found on the sides of loamy bluffs.

18. *Mesodon thyroides*. Say.—Found in the woods or a creek bottom in considerable numbers.

19. *Mesodon clausa*, Say.—I have found a few dead shells but no living ones, and they are evidently scarce.

20. *Bulimulus dealbatus*, Say.—Has been found in one locality in the county and one in Cooper County, about twelve miles from this city. I have not be-

fore known of its occurring so far north, not having heretofore collected it north of Eureka Springs, Arkansas.

21. *Pupa pentodon*, Say.—A few have been found in open timber under logs and sticks.

22. *Pupa fallax*, Say.—Found in stony places, not only under the larger stones, but among small ones where they are thickly imbedded in dirt, a space of a foot square, sometimes furnishing two or three hundred of this and the next species.

23. *Pupa armifera*, Say.—Found along with the last, and also under logs, not imbedded in the ground but above it, and generally encrusted with dirt.

24. *Pupa contracta*, Say.—Rather plenty.

25. *Pupa rupicola*, Say.—Not common.

26. *Pupa nordeacea*, Gabb(?).—A very few of what seem to be this species were found, but the identification is not certain.

27. *Pupa* —— —— (?)—A very small *Pupa* or a *Vertigo*, not yet determined.

28. *Succinea lineata*, W. G. Binn.—In the summer of 1881, a few specimens of what seems to be this species, were found on roots of trees which were standing partly in water. Several searchings during the past summer failed to find a single specimen.

29. *Succinea avara*, Say.—A few were found along the preceding.

30. *Succinea ovalis*, Gould.—Found on the under side of logs in bottoms in open timber The largest were seven mm in length, the typical specimens being given as fifteen mm long.

31. *Tebenophorus carolinensis*, Bosc.

32. *Carychium exiguum*, Say.—Some years ago I found about forty under one log in a creek bottom, but have never since found any.

The water shells are much more numerous than the land shells, though there are not so many species. I have collected the following :

33. *Limnæa columella*, Say.—The only place where I found this was in a fountain in the yard of Mr O. A. Crandall, the eggs having evidently come from Flat Creek through the pipes of the water-works, a distance of two or three miles. In the same fountain occurred *Physa heterostrophe*, *Planorbis trivolois*, and a *Sphæreum*.

34. *Limnæa desidiosa*, Say.—On Spring Fork close by a spring I found this species in abundance, but have not seen it at any other locality. The specimens were eight to ten and a half mm in length.

35. *Limnæa humilis*, Say.—Some five years ago I found great numbers in a small wet-weather pond by the roadside, but when I next visited the locality it had dried up, and there has not since been any at that place. They were six mm in length and quite solid. The only other place where I obtained any was on Flat Creek, where they were smaller, thinner and scarcer.

36. *Physa gyrina*, Say.—Very fine specimens of this were found a few years ago in a wet-weather pond which soon after dried up. They were twenty mm in length with apex eroded so that only three full whorls remained. These

have been identified by different conchologists as the variety *hildrethiana*, Lea, but they were evidently the mature form of others which all identify as *gyrina*. The smaller ones were sixteen mm in length, of six whorls and entire apex.

37. *Physa heterostrophe*, Say.—In no two streams are these shells exactly alike. In some the shell is clear and pellucid; in others quite black. Again at some seasons of the year they will be pellucid and at others black. The size and the shape vary almost as much as the color, and while it is the most common species of the genus, conchological authorities do not agree in their identifications, even as between this and the preceding species. The same process that would make *Stenotrema monodon* and *S. leaii* one species, would also make these one.

38 *Planorbis trivolois*, Say.—Of this common species there are two varieties found. One is about thirteen mm in diameter and the other eighteen mm. The first is more uniformly with basal portion of the labrum horizontally subrectilinear, and not extending below the level of the base, though this is not the case with all, and a part of the larger variety are of that form.

39. *Planorbis bicarinatus*, Say.--Not very common.

40. *Planorbis parvus*, Say.—In November, 1882, I found this species for the first time, and then got only a few specimens from a pond on Flat Creek.

41. *Planorbis* ————.—From Flat Creek I obtained a couple of young shells, between one and two mm in diameter. They do not seem to belong to any of the species before named, and I have not yet been able to identify them.

42. *Ancylus tardus*, Say.—Fine specimens of a reddish color.

43. *Melantho integer*, Say.—Common.

44 *Amnicola porata*, Say.—In the summer of 1881, when the streams were very low, this was obtained in large numbers.

45. *Amnicola orbiculata*, Lea.—This very rare shell was obtained in small numbers with the preceding.

46. *Goniobasis cubicoides*, Anth.—This was found in small numbers at one place in 1881, but during the past year with diligent searching, I could not find any.

47. *Sphæreum partumeium*, Say.—Plenty.

48. *Sphæreum striatinum*, Lam.—Plenty and typical.

49. *Sphæreum stamineum*, Cour.—Rare. Has been found only on Little Muddy.

50. *Pisidium variabile*, Prime.—Not plenty.

51. *Pisidium compressum*, Prime.—A few were found in 1881, but the same locality in 1882 did not furnish any.

As the *Unios* in all our streams are too much eroded to make good cabinet specimens, I have not made an effort to get a full collection of them, and will not now give a partial list. The number of species here given is not equal to those in many local catalogues having a similar fauna, but in some of these latter I have noticed some very doubtful identifications, such as locating a West India species in one of the northwestern States. When necessary corrections shall have been made in each of the lists, the number here will probably be found about the average of more northern localities, with a somewhat larger number of rare species.

THE LIGNIFIED SNAKE FROM BRAZIL.

PROFESSOR ASA GRAY.

The *Popular Science Monthly* for November, and the Bulletin of the Torrey Botanical Club, for the same month, have reproduced an account given in the French *La Nature* last April, of a remarkable phenomenon. The abstract in the Bulletin of the Torrey Botanical Club is the most condensed, and the essential part is copied here: the cut illustrating the object, however, is poor; that in the *Popular Science Monthly* is a somewhat better representation.

"The object represented is a small Brazilian reptile—the jaracaca—which was found within the trunk of an ipe-mirim, a tree of common occurrence in the province of Matto Grosso, to the north of the Amazons, where the specimen was discovered. The piece of wood containing the reptile, after an examination by the scientists of Rio de Janeiro, was taken to France by Mr. Lopez Netto (Brazilian Minister to the United States,) and placed in the hands of Mr. Louis Olivier, who, after a careful study of the specimen, submitted the results thereof to the Botanical Society of France.

"What is astonishing," says Mr. Olivier, in an article on the subject in *La Nature*, 'is that the entire body of the snake is lignified,[1] the anatomical study that I have made of it having shown me that it consists of cells and fibres like those of the secondary wood which surrounds it. It is impossible to explain the fact by saying that there has occurred a formation of these elements in a hollow, which, having been traversed by the animal, has preserved the form of the latter; for on the piece of wood it is not only the contour of the snake that is visible, but, indeed, the whole relief of its body.'

Just beyond the head there is likewise observed in relief a small cylinder which appears to represent the larva of an insect. It seems, then that the snake, in pursuing the latter into a fissure in the tree, has insinuated itself between the wood and the bark into the cambium-layer, which is well known to be the generator of wood and secondary liber. The function of this cambium-tissue is twofold; in the interior it gives rise, in a centripetal direction, to ligneous elements, the youngest of which are consequently found at periphery of the wood; but, toward the exterior, on the contrary, it produces, in a centrifugal direction, liber-fibres, elongated cells, and prosenchymatous elements, the youngest of which are therefore, situated on the internal surface of the bark. If, then, a foreign body be introduced as far as the external limit of the wood, it will, in a few years, become invested with a series of ligneous layers, which are themselves protected by

1 Except the center, in which are found the constituent elements of the animal.

an abundance of bark. Now, in the case under consideration, not only has there been an investment of concentric zones around the reptile, but, besides this, cells and ligneous fibres derived from the cambium-tissues have been substituted for the elements which constituted the external portions of the snake in measure as these have become absorbed. The places that these occupied have, as they gradually disappeared, been taken by secondary wood, whose hypertrophy is proved by the very relief of the snake's body." So far Mr. Olivier.

"The result, as in cases of petrifaction, is that in some parts of the body certain delicate details of the animal's organization are clearly visible. This is especially the case with regard to the nostrils and orbits, and to the arrangement of the scales and cephalic plates over the entire half of the surface of the head."

The narrative in the *Popular Science Monthly* adds from another source the names of the distinguished botanists who were present at the session of the Botanical Society of France, and who are said to have adopted the view of M. Olivier. The Bulletin of that Society in which the proceedings of that meeting is recorded have not yet come to our hands. We shall be much surprised if it fully bears out this statement.

Through the kindness of the Brazilian Minister, we have seen and examined the original specimen, and have been presented with an electrotype of it. It is a great curiosity. The resemblance to a snake is wonderfully close, although "the scales and cephalic plates," which Mr. Olivier identifies with those of a particular Brazilian snake, exist only in a lively imagination. The snake like surface is covered by delicate meshes of woody fibres; and here and there particular fibres or woody threads can be traced from the body to the woody surface.

The adopted explanation requires us to suppose that a snake had forced his way between the bark and wood of a living tree, in a position exactly under a grub or larva; had perished there when within an inch of its prey; was somehow preserved from decay, even to the eye-sockets and the markings of the skin, until a woody growth had formed, the elements of which replaced the whole superficial structure of the animal,—until the animal was lignified! Two other and more probable explanations have suggested themselves. One is, that the snake-like body is of the nature of a root, an aërial root, like those of a *Clusia* or a *Ficus*, which was making its way between bark and wood; and that the supposed larva is an incipient root of the same kind. The other supposes that the sinuous course is the track of a wood-eating larva or some kind of insect, the burrowing of which had not destroyed the overlying liber; consequently the new growth filling the space (except at certain points) had naturally assumed the likeness of a snake. This explanation was suggested by Professor Wadsworth, of Cambridge, examining the specimen along with the writer; and it is to be preferred. Still, that head and neck should be so well outlined, and the former so well represent a pair of orbits, were surely most wonderful. But a close inspection of the electrotype showed that there had been some cutting away at the right side of the neck, and that the narrowing there was in part factitious; and less decisive indications suggested that other outlines had been touched up. The subsequent in-

spection of the original confirmed this; and likewise enlightened us about the eyes. For the left orbit was found to occur, not in woody structure, like that of the right side, but in a dark material having the appearance of pitch or cement of some sort.

We may rest assured that whatever there may be which is factitious in this most curious *lusus naturæ*, originated before it came into the hands of His Excellency the Brazilian Minister at Washington. If these marks were not discerned by any of the Parisian *savants* in question—which we are slow to believe—they are less likely to have been noticed by Señor Lopez Netto, whose honor and good faith are incontestable.—*American Journal of Science.*

PHYSICS.

RESULTS IN AERIAL NAVIGATION EXPECTED FROM THE STORAGE OF FORCE AND THE CHEAPENING OF ALUMINUM.

PROF. E. C. STEDMAN.

The following bit of news, with some remarks by Professor Newberry upon its importance, appeared in the *Tribune* of Thursday, Dec. 14:

"LONDON, Dec. 13.—A process for the cheap production of aluminum has been discovered The invention causes no little excitement in the metal trade at Birmingham and Sheffield."

I contributed to *Scribner's Monthly* February, 1879, an illustrated article entitled "Aerial Navigation (*A Priori*)." In it I gave the gist of certain notes and diagrams made in 1858 concerning the greatest of unsolved mechanical problems —that of the true method of navigating the air, that "element everywhere abounding, covering one all over like a cloak, earth's garment, man's aureola, in which he moves, breathes, and has his being; the most delicate, the strongest of all; invisible, yet making all things plain; light, yet pressing everywhere; elusive, yet waiting to be overcome, and to confer gifts upon its sovereign beyond his most extravagant conjecture!"

In the quoted article I claimed that the model of the future "aërobat" or "aëronon" would be taken from the fish, and not, as many believed, from the bird, but added:

"Various hints, however, may be gained from the bird, one of which relates to the structure of the frame and machinery of a vessel that shall navigate the atmosphere. The hollow bones of the bird furnish the natural model for the union of lightness and and strength in aërial mechanics."

In 1879 three factors were still needed for the successful construction and use of an aëronon built upon the model suggested—that of a "parabolic spin-

dle" in such a state of equipoise that a slight force obtained from a vertical screw would cause it to rise or descend. These requirements were:

A. *A motor distinguished by a greater economy of power than the best hitherto constructed.* After the appearance of my article I received from the eminent Chief Engineer of the Erie Railway, Mr. Octave Chanute, Vice-President of the American Association of Civil Engineers, carefully prepared tables of the ratios of increased atmospheric resistance to increased speed, showing what powerful and economical motors are required to overcome the former. This gentleman also has made experments, by affixing apparatus to railway cars, in order to determine the shape of a moving structure which shall meet with the least resistance from the air.

B. *A Method of Storing Force*, so that it could be applied to the propulsion of the aëronon, with economy of weight, without danger to the structure of ignition, and in quantity sufficient for prolonged flight. I wrote that "the electric engine will be required. Electricity, in fact, will be as indispensable to the aërobat as to one of Jules Verne's imaginary structures. The electric light will flash from its lookout station and illuminate the inner galleries; while the steering and propulsion will be governed by electric signals."

Within this year the marvellous invention of the Faure Accumulator has solved the problem of the *Storage of Force*, and we are assured that equally surprising advances may be expected in its capacity to render a greater amount of energy for the given bulk and weight of the reservoir.

C. *A cheap process of obtaining aluminum in quantity was yet to be discovered.*

I wrote that "lightness and strength" must be the watchword. "All the internal stays, ties, braces, to be made of strong but delicate metallic rods, wire and *tubing*." The following reference was made to the metal best suited for the purpose:

"Some years after I began to think of this subject I fell into conversation with an intelligent machinist, the chance companion of a railway trip. He remarked that he thought that the solution of our problem might depend upon the increased production of aluminum—then a comparatively new metal.

"This, one of the most abundant of metals, is so difficult of extraction from the clay that the cost at that time was $1.80 per ounce. By 1867 it was obtained through an improved process from cryolite, at a cost of ninety cents per ounce. Recent authorities quote the cost of manufacture as low as $4 a pound. Its specific gravity, when hammered and rolled till strong as iron or stronger, compares with that of iron and copper as 2.67 to 7.78 and 8.78 respectively. It is, therefore, but *one-third* as heavy as the lighter of these metals, and even weighs less than glass. There are signs that it will yet be produced so cheaply as to be useful for much of the jointed frame work of our structure, and for portions of the machinery not subject to excessive heat. But though it cost its weight in silver it might well be afforded, if by its use a structure could be made to navigate the air.

"Aluminum bronze, ten parts aluminum and ninety parts copper, has a specific gravity of only 7.69. It is three times more rigid than gun metal, and forty-four times more so than brass; and, in consequence of its transverse, tensile and elastic strength, exceedingly strong tubing and rods could be made of it, at a vast economy of structural weight."

Professor Newberry now tells you that "aluminum, (it is time that metallurgists should make a final choice between the terminations in *inum* and *inium*,) has not been largely used yet, because of the cost that has attended its production, but for a long time everybody has been looking for a cheaper method. The price of it when I first saw it was $8 an ounce, a year ago it was $1 an ounce, and now there is a Philadelphia firm that offers to supply it in large quantities at 40 cents an ounce, while a Connecticut manufacturing company say they that can produce it for less." He continues: "Think how valuable it would be in bridges and all structures in which lightness combined with strength and durability is desired. *If we ever have machines to navigate the air it will be an extremely important element, for it can be easily wrought into tubes that will be strong and light.*"

It is not within my province to enlage upon the thousand departments in which this light, strong and non-corrosive metal will take the place of iron. And we have yet to learn how cheap is the new method of its production, but if your London telegram is well-founded, and if the cost of aluminum can be reduced to any sum approximating the cost of steel, making allowance for the difference in specific gravity of the two substances, we can safely assert that the year 1882 has provided two of the three factors required for the solution of the problem of aërial navigation.

The public may remember that an imperfect machine, in some features resembling my design, has lately achieved a measure of success in France. M. Tissandier is now constructing a spindle-shaped aërobat to be driven by electricity. Owing partly to its disadvantageous separation of the car and aërostat, its speed will not exceed fifteen miles an hour in calm weather.

In Mr. Chanute's "Annual Address," 1880, before the convention of the American Society of Civil Engineers, he spoke as follows:

"There are signs that a new motive power will be invented, which shall be safer, of greater energy, and less wasteful than steam. You know that chemists tell us that the theoretical energy of a pound of coal varies between eight and eleven millions of feet pounds, while we utilize with our best steam engines but from three to eleven per cent of the theoretical value of the fuel. I think it not impossible that we shall perfect methods of employing directly the gases produced from our fuels (instead of using them to generate another gas out of water), and thus obtain better economical results than with steam. I know of several promising attempts in this direction.

"And, with a new motive power, perhaps will come the solution of the last transportation problem which remains to be solved. I suppose you will smile when I say that the atmosphere still remains to be conquered; but wildly improb-

able as my remarks may seem, there may be engineers in this room who will yet see men safely sailing through the air."

I write this letter as a further and timely statement of the advances made toward aërial navigation, and would gladly aid in extending, even thus slightly, the interest felt in the theme. I believe that the time is not far off when capitalists will take hold of the problem with results proportionate to their means and enterprise. The first aëronon of practical value will not be constructed except by skilled engineers authorized to expend upon it at least the half million dollars required for the construction of a steamship. The sum was raised at once for Capt. Ericsson's vessel when he invented his caloric engine, twenty odd years ago. Among the scores of communications which my article of 1879 brought me—not only from more or less intelligent (and "distressed") inventors, each with a model or caveat of his own, but also from amateurs and engineers—those from laymen often made light of the topic or subjected me to severe criticism. To my surprise many professional experts of high standing expressed the greatest interest in my views, and, allowing for the defects and crudeness incident to my limited study of the subject, in the main coincided with them. I judge that the prediction of an early solution of the problem is not without a basis. If it shall be solved, all the results which I have dwelt upon with some enthusiasm most surely will follow apace. A speedy revolution will be observed in the social, commercial and political systems of human life upon this globe —*N. Y. Tribune.*

A THAMES LAUNCH PROPELLED BY ELECTRICITY.

SYLVANUS P. THOMPSON.

Having been one of a privileged party of four, the first ever propelled upon the waters of the River Thames by the motive power of electricity, I think some details of this latest departure in the application of electric science may be of interest.

At 3:30 this afternoon I found myself on board the little vessel Electricity, lying at her mooring off the wharf of the works of the Electrical Power Storage Company at Milwall Save for the absence of steam and steam machinery, the little craft would have been appropriately called a steam launch. She is twenty-six feet in length and about five feet in the beam, drawing about two feet of water, and fitted with a twenty-two inch propeller screw. On board were stowed away under the flooring and seats, fore and aft, forty-five mysterious boxes, each a cube of about ten inches in dimensions. These boxes were nothing else than electric accumulators of the latest type, as devised by Messrs. Sellon and Volckmar, being a modification of the well-known Plante accumulator. Fully charged with electricity by wires leading from the dynamos or generators in the works, they were calculated to supply power for six hours at the rate of four-horse power. These storage cells were placed in electrical connection with two Siemen's

dynamos of the size known as D 3, furnished with proper reversing gear and regulators, to serve as engines to drive the screw propeller. Either or both of these motors could be "switched" into circuit at will.

In charge of the electric engines was Mr. Gustave Phillipart, Jr., who has been associated with Mr. Volckmar in the fitting up of the electric launch. Mr. Volckmar himself and an engineer completed, with the writer, the quartet who made the trial trip. After a few minutes' run down the river, and a trial of the powers of the boat to go forward, slacken, or go astern at will, her head was turned citywards, and we sped—I can not say steamed—silently along the southern shore, running about eight knots an hour against the tide. At 4:37 London bridge was reached, where the head of the launch was put about, while a long line of on-lookers from the parapets surveyed the strange craft that without steam or visible power—without even a visible steersman—made its way against wind and tide. Slipping down the ebb, the wharf at Millwall was gained at 5:01, thus in twenty-four minutes terminating the trial trip of the Electricity.

For the benefit of electricians I may add that the total electromotive force of the accumulators was 96 volts, and that during the whole of the long run the current through each machine was already maintained at 24 amperes. Calculation shows that this corresponds to an expenditure of electric energy at the rate of 3 1 11 horse-power.

It is now forty-three years since the Russian Jacobi first propelled a boat upon the waters of the Neva by aid of a large but primitive electro magnetic engine, worked by galvanic batteries of the old type, wherein zinc plates were dissolved in acid. Two years ago a little model boat was shown in Paris by M. Trouve, actuated by accumulators of the Faure-Plante type. The present is, however, not only the first electric boat that has been constructed in this country, but the very first in which the electric propulsion of a boat has been undertaken on a commercial scale.—*London Times.*

THE COMING MOTIVE POWER.

The simplest and one of the most clever and interesting applications of electricity to purposes of daily use was shown last week by Mr. C. Vibbard in his Broad Street office, where a model of the apparatus and a track was laid the length of the room. It is an automatic safety signal for railway trains. The road is cut up into blocks, which may be only 500 feet or twenty miles in length, as may be desired. A train coming on this block or section from either end automatically operates a simple instrument, which puts all signals on either end of the section, and on any switches that may immediately come in, at "danger." By the same operation, when the train passes off the block the last car releases the instrument, which is hidden under the rails, and safety signals are in turn displayed. There is no dependence upon the rails as conducting mediums, as has been the case with former automatic signals, the electric power being conveyed by an in-

dependent wire running below the ground from an instrument buried under the track, to a telegraph pole where it is held aloft from all disturbing influences. At night red lights are displayed. No weight less than five tons can open or close the circuit. In this way the danger of collision is avoided and likewise the overtaking of a slow train by a fast one, particularly at night on curves. To show how quickly the value of a thing will appreciate if solid people can only be induced to use it, this invention could have been had a couple of years ago for a mere song. After a while the Pennsylvania Railroad was induced to try it on their Tyrone division, the worst railroad division in the United States. Not an accident occurred while it was in use. Then the road ordered it put on the entire line from New York to Philadelphia, Pittsburg and Chicago, and on all connecting lines, and to-day the patent that could have been bought two years ago for a trifle could not be had for $1,000,000.—*N. Y. Cor. Buffalo Express.*

A LOCOMOTIVE WITHOUT A SMOKE-STACK.

Mallett's device for consuming smoke is about to be tested on the Erie railway, on which a consolidated locomotive is being equipped. The smoke-stack disappears entirely, and in its place is a man-hole merely. The gases produced by the complete combustion will escape about the periphery of the extended boiler casing. The fan is worked by a small engine in the smoke box, and a powerful draft is maintained when the locomotive is at rest. The exhaust steam passes along the side of the locomotive to the tender, which is divided into three compartments. The upper one is for fresh water, the middle one contains copper tubes connecting with the external air in front and with a suction fan in the rear. The exhaust steam circulates around the copper tubes and becomes in part condensed, the resulting hot water falling into the lower compartments. The uncondensed steam that comes in contact with a spray of water falling from the upper compartment and the condensed water enters the lowest compartment, whence hot water is pumped into the boiler. The air used to condense the steam is employed for heating and ventilating cars, being delivered through a conduit which, with coupling ends, passes along beneath the cars. This system does away with coal stoves or heaters, and supplies the cars with fresh air and warm air without danger of fire in case of a smash up. When the locomotive now under way is completed, it is proposed to make with it a transcontinental trial trip.—*Railway Age.*

INDUSTRIAL NOTES.

THE CROPS OF 1879, 1881 AND 1882.

The Agricultural Department Statistican, Mr. J. R. Dodge, has just finished the compilation of the crop statistics for the year 1882, which will accompany the annual report of Commissioner Loring. The following exhibit of wheat and corn production, together with the yield for 1879 and 1881, is taken from the report, and will be found of great value:

WHEAT (BUSHELS).

States.	1879.	1881.	1882.
Maine	665,714	617,000	512,100
New Hampshire	169,316	175,000	148,700
Vermont	337,257	378,000	378,000
Massachusetts	15,768	19,000	20,100
Rhode Island	240	260	300
Connecticut	38,742	39,000	43,600
Northeast	1,227,037	1,228,260	1,102,800
New York	11,587,766	10,844,000	12,145,200
New Jersey	1,901,739	2,018,000	2,098,700
Pennsylvania	19,462,405	18,797,000	20,300,700
Delaware	1,175,272	1 044,000	1,200,600
Middle	34,127,182	32,703,000	35,745,200
Maryland	8,004,834	7,213,000	8,665,600
Virginia	4,822,504	7,165,000	8,311,400
North Carolina	3,397,395	4,579,000	5,494,800
South Carolina	962,353	988,000	1,729,000
Georgia	3,159,771	2,933,000	3,812,900
Florida	422	480	600
South Atlantic	23,347,312	22,878,480	28,004,300
Alabama	1,529,657	1,479,000	1,700,800
Mississippi	218,850	197,000	250,100
Louisiana	5,034	5,350	7,000
Texas	2,567,760	3,230,000	4,173,700
Arkansas	1,269,730	1,017,000	1,566,100
Southern	5,591,071	6,037,350	7,697,700
West Virginia	4,001,711	4,413,000	4,854,300
Tennessee	7,331,353	6,408,000	8,971,200

Kentucky	11,356,113	8,625,000	17,250,000
Central	22,689,177	19,446,000	30,075,500
Ohio	46,014,689	38,520,000	45,453,600
Indiana	47,284,853	31,353,000	45,461,800
Illinois	51,110,502	26,822,000	52,302,900
Iowa	31,154,205	18,248,000	25,487,200
Missouri	24,966,627	20,399 000	27,538,600
Kansas	17,324,141	19,909,909	33,248,000
Nebraska	13,847,007	13,840,000	14,947,200
Surplus States . .	231,702,204	169,091,000	244,439,300
Michigan	35,542,543	21,220,000	33,315,400
Wisconsin	24,884,689	17,987,000	20,145,400
Minnesota	34,601,030	35,952,000	37,030,500
Lake	95,018,262	75,159,000	90,491,300
California	29,017,707	28,406,000	34,546,600
Oregon	7,480,010	12,673,000	12,039,300
Nevada	69,298	48,000	49,400
Pacific Coast . .	36,567,015	41,127,000	46,635,300
Colorado	1,425,014	1,310,000	17,598,200
Territories	6,718,829	11,300,000	
	9,203,843	12,610,000	17,598,200
District	6,402	. . . . .	. . . . .
United States . . .	459,479,505	388,280,000	502,798,600

CORN (BUSHELS).

States.	1879.	1881.	1882.
Maine	960,633	1,064,000	904,400
New Hampshire . .	1,350,248	1,262,000	807,700
Vermont	2,014,271	1,990 900	1,930,300
Massachusetts. . .	1,797,593	1,406,000	1,237,200
Rhode Island . . .	372,967	327,000	277,900
Connnecticut . . .	1,880,421	1,427,000	1,115,800
Northeast	8,376 133	7,476,000	6,376,300
New York	25,875,480	20,085,000	20,687,500
New Jersey. . . .	11,150,705	7,820,000	9,942,800
Pennsylvania . . .	45,821,531	34,599,000	41,518,800
Delaware	3,894,264	2,940,000	3,936,600
Middle	86,741,980	65,453,000	76,085 700
Maryland	15,968,533	16,277,000	17,904,700
Virginia	29,106,661	27,200,000	35,994,000
North Carolina . .	28,019,893	23,977,000	34,260,700

South Carolina . .	11,;67,099	8,809,000	15,856,200
Georgia	23,202,018	19,745,000	29,617,500
Florida	3,174,234	3,170,000	8,608,900
South Atlantic .	111,238,384	102,178,000	137,252,000
Alabama	25.441,278	20,250,000	30,982,500
Mississippi	21,340,800	16,646,000	28,233,600
Louisiana	9,906,189	9,693,000	14,636,400
Texas	29,005,172	33,277,000	63,416,300
Arkansas . . .	24,156,417	21,028,000	34,485,900
Southern	109,979,856	101,994,000	171,754,700
West Virginia. . .	14,090,609	12,980,000	14,927,000
Tennessee	62,764,429	36,232,000	73,188,600
Kentucky	72,852,263	51,624,000	79,500,900
Central	149 707,301	100,836,000	167,616,500
Ohio	111,877,124	79,760,000	93,319,200
Indiana	115,482.300	79,618,000	107,484,300
Illinois	325,792,481	176,733,000	187,336,900
Iowa	275,024,247	173.289,000	178,487,600
Missouri	202,485,723	93,069,000	174,037,000
Kansas	105,729,325	76,377,000	150.452,600
Nebraska	65,450,135	58,913,000	82,478,200
Surplus States .	1,201,841,295	737,759,000	973,595,800
Michigan	32,461,452	25,068,000	30,081,600
Wisconsin	34,230,579	29,040,000	30,201,600
Minnesota	14,831,741	13,252,000	21,127,600
Lake	81,523,772	71,360,000	81,410,800
California	1,993,325	3,633,000	2,790,900
Oregon	126,862	101,000	101,000
Nevada	12,891	13,000	11,700
Pacific Coast .	2,133,078	2,747,000	2,903,600
Colorado and Territories	3,379,696	6,113,000	7,500,000
United States. . .	1,754,861,535	1,194,916,000	1,624,917,800

RAILROAD CONSTRUCTION IN THE UNITED STATES DURING 1882.

The *Railway Age* has furnished an advance slip of an interesting article giving an account of the railway construction in the United States during the year 1882.

The following the *Age's* summary of new track actually laid from January 1 to December 1, length of main line only, indicated by distance between termini,

being considered, and no account being made of new sidings or of additional side track:

STATES.	NO. LINES.	MILES.
Alabama	2	37
Arizona	2	192
Arkansas	7	529
California	7	285
Colorado	12	500
Connecticut	1	2
Dakota	16	480
Delaware	—	—
Florida	6	204
Georgia	6	305
Idaho	3	300
Illinois	16	385
Indian Territory	1	60
Indiana	9	528
Iowa	24	953
Kansas	8	217
Kentucky	3	86
Louisiana	4	52
Maine	3	28
Maryland	2	41
Massachusetts	2	5
Michigan	13	223
Minnesota	13	441
Mississippi	3	80
Missouri	12	308
Montana	2	309
Nebraska	5	210
Nevada	1	44
New Hampshire	1	17
New Jersey	5	85
New Mexico	3	21
New York	22	732
North Carolina	10	154
Ohio	17	554
Oregon	3	198
Pennsylvania	31	464
Rhode Island	—	—
South Carolina	3	57
Tennessee	8	133
Texas	19	817
Utah	2	175
Vermont	1	8
Virginia	10	228
Washington Territory	—	—
West Virginia	3	20
Wisconsin	16	397
Wyoming	1	25
Total	316	10,821

Where, as in several cases, the same line has been built in two or more States it is counted as but one line in the grand total, so that the footing under the column "No. of lines"—316—is less by 22 than the actual sum of the number of lines taken separately by States and Territories.

Thus it appears that track laying has been in progress during the year in forty-four of the States and Territories, upon 316 different railways, with the result of adding no less than 10,821 miles to our railway system, and it is not unlikely that this may be increased to 11,000 miles by the final returns. These figures place 1882 far ahead of any other year in respect to railway building, the increase over 1881, hitherto the year of most extraordinary construction, being about 1,500 miles, or more than 16 per cent. For the purpose of comparison there is given below the figures of yearly mileage found in Poor's Manual, assuming them to be approximately correct, and adding our figures for 1882:

YEAR.	MILES BUILT.	TOTAL MILEAGE.
1873	4,107	70,278
1874	2,105	72,383
1875	1,712	74,096
1876	2,712	76,808
1877	2,281	79,089
1878	2,687	81,776
1879	4,721	86,497
1880	7,174	93,671
1881	9,386	104,813
1882	10,821	115,634

In regard to the prospects for future construction of the 316 roads which are covered by this record, at least 140 are still uncompleted, and on many of these work will be resumed in the spring, if it is not continued during the winter. Bearing in mind that the number of lines on which grading was actively in progress during the year, although no track was laid, is very large, and that a host of new projects have been inaugurated upon which no tangible work has yet been done, and it appears that railway building is likely to be active during 1883, though it will probably be better for the country if it does not proceed with the extraordinary speed which has characterized the past two years.

The amount of capital which has been invested in railways in the last year is almost incredible. Allowing $25,000 per mile as a fair average for the cost of a road equipped and in operation, the 10,800 miles of which we have record have cost $270,000,000, to which is to be added the vast and unknown sum expended in preparing road beds in which track is not yet laid.

BATES COUNTY COAL MINES.

The shipping of coal from Rich Hill began in the fall of 1880. Late in October the Rich Hill Coal Company commenced operations on a small scale from surface mines, but on account of insufficient rolling stock on the Missouri Pacific

railroad, the coal company were unable to keep their employees at steady work, and consequently were unable to supply the demand for coal. The number of cars shipped out that fall and the following year of 1881 amounted to 8,706. During the past year of 1882 the shipments have been as follows:

1882.	CARS.
January	1,439
February	1,379
March	1,286
April	1,043
May	1,020
June	812
July	1,294
August	1,901
September	1,879
October	1,101
November	2,251
December	2,404

The average car load, by actual weight, exceeds sixteen and one-half tons.

The shipments of the Gulf road have not been quite as large as those over the Missouri Pacific, but still make a good showing. Coal was first shipped over the Gulf road about the 1st of October, 1880, and during that year 3,081 cars were sent out; in 1881 the shipments ran up to 17,436. During 1882 Keith & Perry, the principal shippers over the Gulf road, were developing new mines, and a large portion of the year shipped but very little coal, but the total for the year runs up to 12,960 cars, and their shipments now average 65 cars per day. This makes a total shipment over the Gulf road since its construction, of Coal from Rich Hill, of 23,477 cars, up to December 31st, 1882, and over the Missouri Pacific of 27,221 cars, or a grand total of 50,698 cars, or 329,537 tons.

During all this time there has been a very large output for the local trade, which has made the coal business of good proportions for a new mining field. — *Rich Hill (Mo.) Mining Review.*

REPORT OF THE KANSAS CITY STOCK YARDS FOR 1882.

This report, made by E. E. Richardson, Secretary, shows the receipts at the yards for the year to have been as follows: Cattle, 439,671; Hogs, 963,036; Sheep, 80,724; Horses and Mules, 11 716. The shipments were: Cattle, 439,-521; Hogs, 961,906; Sheep, 80,708; Horses and Mules, 11,607. Total receipts in twelve years: Cattle, 2,722,291; Hogs, 4,657,606; Sheep, 457,719; Horses and Mules, 88,614. Grand total 7,926,230.

COLORADO COAL.

The coal deposits of Colorado are practically inexhaustible, and they are to be found in almost every portion of that State. The Denver *Republican* in a recent issue gives some interesting statistics concerning them. The northern belt —in three counties—some twenty mines, are now being worked, the coal from which is free-burning, semi-bituminous, and of fair quality, the output for last year having amounted to 550,000 tons. The middle region—that lying between Denver and Colorado Springs—from the only mine being worked the output during the last half of the year was some 34,000 tons; while in the southern belt, which includes Trinidad and El Moro, the entire region is rich in fine quality of coking coal. At the Starkville mine 100,000 tons were mined and shipped last year, the value of which loaded on the cars was about $2 per ton. At the same point forty coke ovens are in operation, the product of which is worth $4.50 per ton, and all of which goes to Arizona. The Eagle mine shipped 400,000 tons of coal and 12,000 tons of coke, and another mine produced 20,000 tons of coal. The output of coal from the Cañon region was 160,000 tons for the year; while that from the Gunnison country was 43,500 tons of soft and 2,000 tons of anthracite coal. The Colorado Coal & Iron Company manufactured at their mines at Crested Butte 10,000 tons of coke.

The area of soft coal land outside of Crested Butte is very extensive, coal of more or less degree of excellence being found under hundreds of square miles throughout Gunnison County. The anthracite coal is found over an extensive territory, but much of it is inaccessible and of an inferior quality. The best coal is found at the head of Anthracite Creek, about three miles from Crested Butte. An equally good quality is also found on Rock Creek; but the immense seams found down Anthracite Creek toward the North Fork of the Gunnison River hardly come up to the Pennsylvania standard of excellence. The anthracite trade of this region is yet in its infancy, but when preparations that are now being made for mining and handling it are once fairly under way, it will probably be able to furnish 200 or 300 tons per day, and the demand will inevitably increase. The coal is in all respects the equal of the Pennsylvania anthracite, chemical analysis and physical structure failing to show any material difference.

La Plata County is also very rich in excellent coal, the largest vein of which is the Mammoth, near Durango, which is 52 feet in width. In this county the seams are numerous and large, and for the most part so situated as to allow of cheap and expeditious mining. The character of the coal is mainly bituminous and well adapted to coking, though some of the seams yield a steam coal of remarkably good quality. The output in 1882 from the various mines there was about 5,900 tons, to which should be added the output of the railroad mine at Monero, which is in this belt, which produced 12,000 tons, making a total of

17,900 tons for the county for the year. At Como, in Park County, 75,000 tons of coal and 96,000 tons of coke were sent to market.

In summing up, the *Republican* says: Coal was produced in other sections of the State, of which no returns could be secured, but it is believed that 100,000 tons will cover it all. The output was, in other words, nearly 2,000,000 tons, valued at about $4,000,000 at the mines. The anthracite output, nearly 2,000 tons, value about $10,000, and the coke production reached the sum of nearly 100,000 tons valued at $4.50 at least, a total of at least $450,000, making the value of entire coal output $4,460,000.—*Age of Steel.*

BULLION PRODUCT OF COLORADO.

The Denver *Tribune* gives the following table of the bullion product of Colorado for 1882:

COUNTY.	AMOUNT.
Boulder	$ 550,000
Chaffee	225,500
Custer	705,116
Clear Creek	2,001,629
Dolores	125,000
Fremont	19,960
Gilpin	2,006,516
Grand	10,000
Gunnison	600,000
Hinsdale	275,000
Lake	17,131,853
La Plata, San Juan	175,000
Ouray	329,760
Park	283,564
Pitkin	100,000
Rio Grande	310,000
Routt	100,000
Sagauche	52,000
Summit	1,250,000
Totals	$26,750,898

The product for 1881 was $22,203,509, showing an increase this year of $4,547,389.

LAKE COUNTY.—The following table gives the bullion output of Leadville for the year ended December 30, 1882:

	QUANTITY.				
	POUNDS OF BULLION.	POUNDS OF LEAD.	TONS OF ORE.	OUNCES OF SILVER.	OUNCES OF GOLD.
Total 1st quarter	23,487,082	23,380,743	12,924	2,042,323	3,056
Total 2d quarter	20,510,096	20,415,647	12,175	1,838,596	2,886
Total 3rd quarter	22,713,006	22,605,015	28,050	1,743,876	6,548
Total 4th quarter	19,747,065	19,646,027	36,953	1,648,454	3,923
Total for year 1882	86,457,349	86,047,412	90,101	7,273,249	16,413

VALUE.

	VALUE OF LEAD.	VALUE OF SILVER.	VALUE OF GOLD.	VALUE OF ORE.	TOTAL VALUE.
Total 1st quarter .	$1,169,037	$2,328,248	$ 61,120	$ 485,762	$ 4,044,167
Total 2d quarter .	1,020,779	2,093,301	49,720	599,059	3,773,772
Total 3d quarter .	1,130,251	1,988,142	130,960	1,326,111	4,575,334
Total 4th quarter .	942,977	1,827,561	78,457	1,885,134	4,734,129
Total for year 1882.	$4,263,044	$8,237,252	$320,257	$4,296,066	$17,127,402

Total for 1881 amounted to $13,170 576, showing an increase this year of $3.956,826. In figuring the commercial value of the last quarter's product, silver is calculated at $1.11 per ounce, and lead 4·8 per pound. Previous productions were calculated on a fair average of the ruling quotations at the time.—*Engineering and Mining Journal.*

MEDICINE AND HYGIENE.

SEWER GAS AND ITS DANGER TO HEALTH.

WM. PAUL GERHARD, C. AND S. E.

Many erroneous ideas still prevail about sewer gas and its danger to health which arises, by having so-called "modern conveniences" in our dwellings. It is the purpose of this paper, without in any way adding to the "plumbing scare," clearly to define wherein the danger consists, but at the same time to establish rules for the proper draining and plumbing of houses, which, if carefully observed, will secure to the anxious house owner work of superior quality and of a positively safe character.

Plumbing fixtures, which were considered a luxury years ago, are now believed to be necessary, not only for comfort and convenience, but also, and even more so, for health and for cleanliness. Even a small house is nowadays generally provided with a kitchen sink, a water closet, and sometimes a bath-tub, while in a costly modern residence, arranged with an elaborate system of plumbing, we find kitchen, pantry and scullery sinks, slop sinks, laundry tubs, stationary wash-basins in closets near bed-rooms, a great number of bath or dressing-rooms, with water-closets, urinals, bath and foot tubs, bidets and other fixtures.

The suggestions and recommendations of this report apply with equal force to the drainage and plumbing of tenements, small houses, costly residences, villas, apartment houses, hotels, factories, school houses or public buildings. As every plumbing fixture is not only an outlet for the waste water to the drain, but possibly may become an inlet for drain air, the danger increases with the number

of fixtures. A multitude of fixtures requires a large number of soil and waste pipe-stacks, and the chance of leakage of sewer gas through defective joints increases correspondingly. But be the house large or small, its drainage and plumbing system should always be so arranged as entirely to exclude any possibility of the escape of sewer gas.

SEWER GAS.—I shall, first, briefly consider what is meant by the term "sewer gas. This term, as Prof. W. Ripley Nichols has truly said,[1] is "an unfortunate one, and gives rise to a quite widespread but very erroneous idea. Many seem to suppose the 'sewer gas' to be a distinct gaseous substance, which is possessed of marked distinguishing characteristics, which fills the ordinary sewers and connecting drains, and which, as a tangible something, finds its way through any opening made by chance or by intention, and then, and only then, mixes with the atmospheric air."

Sewer gas is a mechanical mixture of a number of well known gases, having their origin in the decomposition of animal or vegetable matter, with atmospheric air. This mixture is continually varying, according to the more or less advanced stage of putrefaction of the foul matters, which form a sediment and a slimy coating of the inner surfaces in drains and pipes. It is also variable with the character of this sediment or deposit, and with the physical conditions (moisture, heat, etc.) under which the decomposition takes place.

The principal gases found in sewers and drains are oxygen, nitrogen, carbonic dioxide, carbonic oxide, ammonia, carbonate of ammonia, sulphide of ammonium, sulphuretted hydrogen and marsh gas.

The three first-named gases are the principal constituents of the atmosphere surrounding the globe, and are found present in the following *average* proportion, viz:

20.9 vols. oxygen } in 180 vols. of air, together with 2 to 5 vols. carbonic dioxide in 10,000 vols. of air.
79.1 vols. nitrogen }

According to R. Angus Smith the amount of *oxygen* is:

In the average, 20.96 vols. in 100 vols. of air.
In pure mountain air, 20.98 vols. in 100 vols. of air.
At the sea shore, 20.999 vols. in 100 vols. of air.
In streets of populous cities, 20.87 to 20.90 vols. in 100 vols. of air.

The air in sewers and drains contains much less oxygen, as some of it combines with the carbon of putrefying organic matter forming carbonic dioxide. The amount of nitrogen in the air of sewers is little different from that in the atmosphere which we breathe; but the amount of carbonic dioxide present is greatly increased.

The lowest amount of oxygen in sewer air is recorded to be 17.4 vols. in 100 vols. of air; the amount of carbonic dioxide is in the *average* 2.3 vols. in 100 vols. Sulphuretted hydrogen varies greatly, but the quantity is generally so small as not

1 See Prof. Ripley Nichols' Report upon Chemical Examination of the Air of the Berkeley Street Sewer, in Boston, Mass., 1878.

de rmined. Still more difficult is it to find by chemical analysis the proportion of ner g"es of decay.

In well ventilate and well flushed sewers, Dr. Russell, of Glasgow, found the following ratio:

20.70 vols. of oxygen in 100 vols. of air.
78.79 vols of nitrogen in 100 vols. of air.
0.51 vols. of carbonic dioxide in 100 vols. of air.
No sulphuretted hydrogen in 100 vols. of air.
Traces of ammonia in 100 vols. of air.

Carbonic oxide is present only in excessively minute quantities, and even then it may have entered the sewer or drain through leakage of illuminating gas from gas mains.

In the absence of more satisfactory methods of analysis, it is usual with chemists to determine the amount of pollution of the air, or the organic matter in it, by determining the amount of carbonic dioxide present, assuming that there is a certain fixed proportion between the amount of carbonic dioxide and the organic matter.[1] Thus, Prof. W. Ripley Nichols records as the average of many carefully conducted experiments in Boston, the amount of carbonic dioxide in a sewer in that city as follows:

The average of
31 determinations in January, 1878, was 8.7 vols. of CO_2 in 10,000 vols. of air.
44 determinations in February, 1878, was 8.2 vols. of CO_2 in 10,000 vols. of air.
47 determinations in March, 1878, was 11.5 vols. of CO_2 in 10,000 vols. of air.
12 determinations in April, 1878, was 10.7 vols. of CO_2 in 10,000 vols. of air.
8 determinations in June, 1878, was 27.5 vols. of CO_2 in 10,000 vols. of air.
8 determinations in July, 1878 was 21.9 vols. of CO_2 in 10,000 vols. of air.
6 determinations in August, 1878, was 23.9 vols. of CO_2 in 10,000 vols. of air.
7 determinations in January, 1879. was 8.0 vols. of CO_2 in 10,000 vols. of air.
14 determinations in February, 1879, was 11.6 vols. of CO_2 in 10,000 vols. of air.
20 determinations in March, 1879, was 11.8 vols. of CO_2 in 10,000 vols. of air.

He remarks: "It appears from these examinations that in such a sewer as the one Berkeley Street, which, being of necessity tide-locked, is an example of the worst type of construction, the air does not differ from the normal standard as much as many, no doubt, suppose. In a general way, as we have seen, there is a larger amount of variation from normal air during the warmer season of the year; but even when the amount of carbonic acid was largest, it was only extremely seldom that sulphuretted hydrogen could be detected." * * * "I think that it should be said that the soil pipes and house drains are much more likely causes of discomfort and danger than the sewers."

Hence the importance of a thorough ventilation of all the soil, waste and drain pipes in a building.

1 Such is strictly tr e only for air fouled by respi ation, while it may not give accurate results in other cases.

In regard to this interesting question I must refer to the Report of Prof. Ira Remsen on the subject of organic matter in the air, published in the National Board of Health Bulletin, Vol. II No. 11.

Are the above-named constituents of sewer air the origin or cause of the sickness so commonly attributed to the inhaling of sewer gas?

Although many of the gases named are poisonous, if inhaled into the system in large quantities, and may, even if present in smaller quantities, cause nausea, asphyxia, headache, vomiting, etc., none of them can be said to *produce* any of the so called "filth diseases." To determine the exact origin of these is a still unsolved problem of physiology. While some believe that the particles of de composing organic matter, present in sewer air and known as "organic vapor" cause disease, others seek the origin of the latter in microscopic *spores* or *germs* which live and feed upon such organic vapor and are capable of reproduction under favorable conditions, such as presence of putrefying filth, excess of moisture, heat, lack of oxygen, etc.

Whatever theory may be accepted as true, it is evident that, by preventing the decay of organic matter within sewers, drains and soil pipes, or by depriving these germs (if such be the cause of disease) of the conditions facilitating their reproduction, we can best prevent the outbreak of excremental diseases. In other words, *by completely removing as speedily as possible all waste matters from the dwelling by pipes thoroughly and tightly jointed, and by a sufficient dilution of the air in these pipes with oxygen, the danger of infection, arising from defective drainage and plumbing, may be reduced to a minimum.*

It should be mentioned that some hygienists, notably Dr. Soyka and Dr. Renk, both assistants of Pettenkofer in Munich, have lately denied the existence of any positive proof of a connection between sewer gas and the spread of epidemic diseases—just as Naegeli and Emmerich doubt the possibility of infection from drinking water contaminated by sewage. Dr Renk considers the exclusion of gases of decay of the interior of dwellings necessary only so far as they are offensive to the sense of smell. In this view, however, I cannot concur; in regard to "filth diseases," their causes and origin, I accept the theory of Drs. Simon, Parkes and others. * * * —*Van Nostrand's Magazine.*

THE TREATMENT OF DIPHTHERIA.

[*Rules adopted on the subject by the Philadelphia Health Authorities.*]

The great degree of fatality attending sickness from diphtheria, particularly among children, makes it important that every precaution be taken against the spread of the disease, and that the treatment of those coming down with it be prompt and intelligent. In view of the general lack of information with regard to the proper treatment of diphtheria patients, the resolutions just adopted by the Philadelphia Board of Health are interesting and valuable. These resolutions have been printed and given to the teachers of public and private schools for distribution among their pupils. By way of parenthesis, it may be remarked that every particular with regard to the unsatisfactory sanitary condition of the Jackson School, recently brought out in the *Globe-Democrat*, has been verified by th

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report of the City Health Officers of St. Louis, who have just completed investigation in the neighborhood. The report of the Philadelphia Board of Health is as follows:

Recent investigations having proved that the poison of diphtheria is portable, communicable by infection, and capable of reproducing itself outside of the human body, diphtheria must now be ranked as both a contagious and infectious disease. The following rules are, therefore, more imperative than ever before:

1. When a child or young person has a sore throat, a bad odor to its breath, and especially if it has a fever, it should immediately be separated and kept secluded from all other persons except necessary attendants, until it be ascertained whether or not it has diphtheria or some other communicable disease.

2. Every person to be sick with diphtheria should be promptly and effectually isolated from the public. Only those persons who are actually necessary should have charge of or visit the patient, and these visitors should be restricted in their intercourse with other individuals. Children residing in a house where there is a case of diphtheria should not be permitted to attend school.

3. When a case of diphtheria is fully developed, the same precautions in regard to free ventilation, disposal and disinfection of discharges, bed or body linen, etc , isolated during convalescence (or management of the corpse, should death unfortunately occur), etc., etc., ought to be enforced which have already been recommended in regard to small-pox.

4. It is particularly important that persons whose throats are tender or sore from any cause should avoid possible exposure from the contagion of diphtheria. Children under ten years of age are in much greater danger of taking the disease, and after they do take it of dying from it, than are grown persons. But adults are not exempt, and mild cases in them may cause whole series of fatal attacks among children.

5. Numerous instances are recorded where the contagion has retained its virulence for weeks or months, in cesspools, heaps of decaying vegetable matter, damp walls, etc., and been carried for long distances in clothing, in sewers, in waste pipes from stationary wash stands, and in other conduits. Hence all sewer connections and other carriers of filth should be well ventilated and disinfected, and children particularly should not be allowed to breathe the air of any water closet, cesspool or sewer into which discharges from patients sick with diphtheria have entered, nor to drink water or milk which has been exposed to such air.

6. Beware of any person who has a sore throat; do not kiss such a person or take his or her breath; do not drink from the same cup, blow the same whistle, nor put his pencil or pen into your mouth.

7. Do not wear nor handle clothing which has been worn by a person during sickness or convalescence from diphtheria.

METEOROLOGY.

METEOROLOGICAL SUMMARY FOR THE YEAR 1882.

PREPARED BY PROF. F. H. SNOW, OF THE UNIVERSITY OF KANSAS.

The weather of 1882 abounded in superlatives. It had the highest mean temperature, the highest maximum barometer, the smallest and best distributed rain-fall, the coolest summer, the warmest autumn, and, with one exception (1877) the warmest winter months upon our fifteen years record. Notwithstanding the extremely small rain-fall, crops of all kinds were abundant, in most cases surpassing all previous yields. This furnishes further confirmation of the statement of our reports of 1871 and 1875, that a comparatively small amount of rain, well distributed, is more desirable than a larger amount unfavorably distributed.

TEMPERATURE.—Mean temperature of the year, 54.94° which is 1.51° above the mean of the fourteen preceding years. The highest temperature was 105° on September 12th; the lowest was 6.5° below zero on the 7th day of December, giving a range for the year of 111.5°. Mean at 7 A. M., 49.21°; at 2 P. M., 63.95°; at 9 P. M., 53.30°.

Mean temperature of the winter months, 35.19°, which is 5.18° above the average winter temperature; of the spring, 54.67°, which is 0.72° above the average; of the summer, 72.92°, which is 3.61° below the average; of the autumn, 56.97°, which is 3.81° above the average.

The coldest month of the year was December, with mean temperature 31.25°, the coldest week was January 16th to 22d, mean temperature 25.01°; the coldest day was December 7th, mean temperature 3.2°. The mercury fell below zero only once, on December 7th, not having previously touched zero since February 19, 1881.

The warmest month was June, with mean temperature 74.14°; the warmest week was June 27th to July 3rd, mean 82.83°; the warmest day was June 28th, mean 84.2°; the warmest hour was 2:30 to 3:30 P. M., September 12th, mean 105°. The mercury exceeded 100° on two days, September 12th and 13th, and reached or exceeded 90 on forty days, viz: 1 in May, 12 in June, 9 in July, 11 in August, and 7 in September.

The last hoar frost of spring was on May 22d, the first hoar frost of autumn was on October 19th, giving an interval of 150 days, or nearly five months entirely without frost. The last severe frost of spring was on March 24th, the first severe frost of autumn was on the 11th day of November, giving an interval of 232 days, or nearly eight months, without severe frost. This is the longest period

of immunity from severe frost in the past fifteen years. No frost during the year caused damage to fruit buds or trees. The hoar frost of May 22d injured strawberries in some localities.

RAIN.—The entire rainfall, including melted snow, was 27.60 inches, which is the smallest annual rainfall on our fifteen years record, and is 7.12 inches below the average. Either rain or snow, or both, fell on 102 days, one less than the average. On fourteen of these days the quantity was too small for measurement.

The longest drouth in the fifteen years of observation, was from July 30th to September 18th, during which period of seven weeks less than a tenth of an inch of rain was registered. This drouth was not disastrous, because the staple crops were already well matured before the drouth began.

The number of thunder showers was twenty six. Hail fell on seven days.

SNOW.—The entire depth of snow was eighteen inches, which is 3.31 inches below the average. Of this amount two inches fell in January, two in February, nine in March and five in December. Snow fell on fourteen days. The last snow of spring was on March 9th, the first snow of autumn was on November 16th.

FACE OF THE SKY.—The average cloudiness of the year was 45.41 per cent. which is 1.08 per cent. above the average. The number of clear days (less than one-third cloudy) was 162; half clear (from one to two thirds cloudy) 103; cloudy (more than two-thirds) 100. There were eighty days on which the cloudiness reached or exceeded 80 per cent. There were fifty-three entirely clear and forty-seven entirely cloudy days. The clearest month was August, with a mean of 32.37 per cent.; the cloudiest month was December, mean 61.61 per cent. The percentage of cloudiness at 7 A. M. was 50.41; at 2 P. M. 49.82; at 9 P. M. 35.99.

DIRECTION OF THE WIND.—During the year, three observations daily, the wind was from the S W. 272 times; N.W. 269 times; S.E. 155 times; S. 128 times; N.E. 102 times; N. 72 times; E. 71 times; W. 26 times. The south winds (including southwest, south and southeast) outnumbered the north (including northwest, north and northeast), in the ratio of 555 to 443.

VELOCITY OF THE WIND.—The number of miles traveled by the wind during the year was 137,736, which is 687 miles below the annual average for the nine preceding years. This gives a mean daily velocity of 377 miles and a mean hourly velocity of 15.71 miles. The highest hourly velocity was sixty miles on March 21st, the highest daily velocity was 919 miles on January 16th; the highest monthly velocity was 16 608 miles in March. The three windiest months were March, April and May; the three calmest months were July, August and September. The average velocity at 7 A. M. was 14.51 miles, at 2 P. M. 17.73 miles, at 9 P. M. 15.49 miles.

BAROMETER.—Mean height of barometer column, 29.113 inches, which is with one exception (1874, 29.121 inches) the highest annual mean on our record. Mean at 7 A. M. 29.141 inches; at 2 P. M., 29.085 inches: at 9 P. M. 29.114 inches; maximum 29.985 inches on December 17th, which is more than two-tenths of an inch higher than any previous maximum; minimum 28.349 inches

on March 26th; yearly range, 1.636 inches. The highest monthly mean was 29.200 inches in January; the lowest was 28.992 inches in June. The barometer observations are corrected for temperature and instrumental error.

RELATIVE HUMIDITY.—The average atmospheric humidity for the year was 68.23; at 7 A. M. 79.65; at 2 P. M. 50.95; at 9 P. M. 75.31. The dampest month was December, with mean humidity 76.70; the driest month was September, mean humidity 59.20. There were fourteen fogs during the year. The lowest humidity for any single observation was 7 per cent. on September 12th. This extreme dryness of the air existed during the continuance of the withering simoon of that date

1882	Mean temperature	Maximum temperature	Minimum temperature	Miles of Wind.	Relative Humidity.	Rain—In.	Snow—In.	Mean Cloudiness.
January	32.68	65.0	5.0	11,673	66.25	0.70	2.0	51.72
February	41.65	73 0	12.0	11,907	69.70	1.66	2.0	45.59
March	45.90	77 0	17.0	16,608	64.93	1 62	9.0	40.22
April	56.83	88.0	35.0	14,226	61.77	3.20	0.0	51.77
May	60.27	90.0	36.5	13,695	66.40	3.53	0.0	63.44
June	74.14	99.0	44.5	10,874	69.90	4.72	0.0	38.99
July	72.05	99 0	52.0	7 464	75.00	4 03	0.0	38.92
August	72.55	95.0	52.5	7,463	72.40	0.09	0 0	32 37
September	69.30	105.0	46.0	10,026	59 20	1.65	0.0	35.67
October	58.54	84 5	34.0	11,435	69.20	3 08	0.0	41.51
November	43.07	80.0	20.0	11,118	72 00	2.08	0.0	43.11
December	31.25	58.0	–6 5	11,247	79 70	1.24	5.0	61.61
Means	54.94	84 6	29.0	11,478	68.63	2.30	1.5	45.41

COMPARISON WITH PRECEDING YEARS.

YEAR.	Mean temperature	Maximum temperature	Minimum temperature	Miles of Wind.	Mean Cloudiness.	Relative Humidity.	Rain—In.	Snow—In.	Rainy days.
1868	53.36	101.0	–16.5	. . . .	43.35	. . .	37.48	27.50	77
1869	50.99	96.0	– 5.0	. . . .	49.23	78 2	38 51	16 50	105
1870	54.50	102.0	–10 0	. . . .	47.88	68.4	31.32	9.50	100
1871	54 30	103.0	– 6.0	. . .	47.37	65.9	33.23	29.75	120
1872	51.90	97.0	–18.0	. . . .	44 33	64.4	32.63	23.25	116
1873	52.71	104.0	–26 0	154,508	42 46	64 0	32.94	26.50	101
1874	54 20	108.0	– 3.0	145,865	45.54	65.7	28.87	43 10	99
1875	50.60	99.0	–16.0	145,316	44.81	66.7	28.87	5.00	106
1876	52.76	98 0	– 5.0	148,120	41.27	66.8	44.18	24 75	102
1877	54.16	99.0	– 9.0	113,967	47 12	72 6	41.09	15.50	126
1878	55.33	98.0	– 6 0	125,793	40.65	70.2	38.39	25.50	107
1879	54 67	99.5	–16 5	124,768	40.01	67.1	32.68	10.35	90
1880	54.01	101.0	–12.0	146,039	40.15	67.9	32.65	7.00	89
1881	54.65	104 0	– 8 0	141,430	47.52	70.1	33 27	32.50	110
1882	54 94	105 0	– 6.5	137,736	45 41	68 6	27 60	18.00	102
Mean of 15 years.	53.53	101 0	–12.2	138,377	44.40	68 3	34.25	21.07	103

The foregoing tables give the mean temperature, the extremes of temperature, the velocity of wind, the percentage of cloudiness, the relative humidity, the rainfall (including melted snow), and depth of snow, for each month of the year 1882, and a comparison with each of the fourteen preceding years.

REPORT FROM OBSERVATIONS TAKEN AT CENTRAL STATION, WASHBURN COLLEGE, TOPEKA, KANSAS.

BY PROF. J. T. LOVEWELL, DIRECTOR.

The usual summary by decades is given below.

TEMPERATURE OF THE AIR.	Nov. 20th to 30th.	Dec. 1st to 10th.	Dec. 10th to 20th.	Mean.
MIN. AND MAX. AVERAGES.				
Min	21.3	14.5	16.4	17.4
Max	45.9	46.1	45.4	45.8
Min. and Max	33.6	30.3	30 9	31.6
Range	23.6	31.5	29 0	28 0
TRI-DAILY OBSERVATIONS.				
7 a. m.	28.2	23.5	25.8	25.8
2 p. m.	41.4	35.7	40.7	39 3
9 p. m.	30 6	26.3	32.4	29.8
Mean	31.7	29 6	33.0	31.6
RELATIVE HUMIDITY.				
7. a m.	.87	. .	. .	. .
2 p. m.	.64	. .	. .	. .
9 p. m.	.70	. .	. .	. .
Mean	.76	. .	. .	. .
PRESSURE AS OBSERVED.				
7 a. m.	29.13	29.07	28.78	28.99
2 p. m.	29.07	29.05	28.75	28 96
9 p. m.	29.11	29.08	28.80	29.00
Mean	29 10	29.07	28.79	28 98
MILES PER HOUR OF WIND.				
7 a. m.	7.5	9.7	. .	. .
2 p. m.	12.7	16.5	. .	. .
9 p. m.	12.6	13.6	. .	. .
Total miles	2862	4125	2852	9839
CLOUDING BY TENTHS.				
7 a. m.	2.2	6 3	. .	. .
2 p. m.	5.1	6.8	. .	. .
9 p. m.	4.5	5.0	. .	. .
RAIN.				
Inches	.12	.00	.70	.82

The Sun was not visible for a moment at this station, December 6th, so no one saw the transit of Venus. The morning of December 7th the minimum thermometer recorded 11°. At sunrise the standard thermometer was at 6.5°.

Snow fell on the 6th and 19th, and ice on the river has been about four inches thick. There have been during the month more meteors than usual visible, thus verifying the predictions of astronomers.

THE METEOROLOGY OF SHAKESPEARE.

We may safely assume that Englishmen in the olden time, like their sons in these days, took much interest in the weather. They discussed the influence of the past portions of a season, the effects of the present showers or sunshine, and the good or evil signs for the coming day, month, or year. For this they had even stronger inducements than ourselves. A wet harvest time might bring the perils of actual famine home, not merely to scattered individuals, but to entire districts. Further, the weather and its signs were looked on in what we should regard as a superstitious light. Unusual seasons over and above their own unpleasantness were held to forbode foreign wars or civil tumults, pestilence and other calamities. It may be, therefore, not uninteresting to glance at the weather-lore of our forefathers, and ask in how far their rules for a foreknowledge of the season were well founded. For connecting this subject with the name of Shakespeare we have good reason. We have no certainty as touching the scraps and jingles in which popular meteorology is embodied. They may be old as the hills, or they may date no further back than the last century, and may have been blended with the results of modern investigation. But for the passages on this subject which we find here and there in the writings of Shakespeare we have a minimum limit. They must represent the traditions current in the days of his youth, and which had been handed down for at least a couple of generations. They must have arisen in an age when the barometer, the thermometer, and all other meteorological instruments were still unknown.

The first point we notice is that the south wind is held in strange disrespect. It is regarded as unhealthy, as boisterous and wet, and as especially connected with fog. Thus we read—

> "All the contagions of the south light on you."
>
> *Coriolanus*, I., 8.

> "A south-west blow on ye
> And blister you all o'er!"
>
> *Tempest*, I., 4.

Elsewhere we find—

> "The south fog rot thee!"

And again—

> "Like foggy south puffing with wind and rain."

In short this wind is never well spoken of by Shakespeare, except in one passage:

> —— "Like the sweet south
> That breathes upon a bank of violets,
> Stealing and giving odour."
>
> *Twelfth Night*, I, 1.

So exceptional are these lines to all other references to the south wind that in Knight's Cabinet Edition an amendment is proposed. The editor would read "sound" for "south."

It is scarcely necessary to say that this emendation involves greater difficulties than the one it is intended to remove. Shakespeare assuredly would never have likened a strain of music to a "sound," nor spoken of a sound carrying along with it the odours of the violets.

But how comes the poet to couple the south wind with fogs? We know that fogs are exclusively connected with the "polar current," *i. e.*, northerly or easterly winds, though of course so gentle as to be only just perceptible. The moment the wind turns to the south or southwest London breathes afresh, and finds that the threatened doom of the great city is not yet. Besides, one of the passages quothed is self-contradictory. "Foggy south puffing with wind and rain!" Puffing wind and rain, from whatever quarter, dispel a fog.

Nor are the charges of unhealthiness brought against the south much better founded. The southwest wind, especially, blowing as it does over a wide expanse of ocean, is exceedingly unlikely ever to have wafted any pestilence to the shores of England. We think of the proverb still current in Yorkshire and Lincolnshire:

> "When the wind is in the west
> The weather is the best;
> When the wind is in the east
> It's neither good for man nor beast."

It is still possible that as fens and marshes were much more abundant in the Elizabethan age than they are now, and that as the south wind is generally accompanied by warm weather, malaria may have been more common in times of southerly winds than when the weather was colder. But in all other respects we cannot do other than pronounce the epithets which Shakespeare applies to the south wind grossly libelous, and the traditions upon which they are founded instances of loose observation. We should, indeed, be glad to escape coming to this unfavourable conclusion; for our great poet, though his attention was mainly fixed upon human passion and human character, had yet a keen eye for external Nature, as we shall show below. The Ancient Britons are said to have applied the name "cloudy or misty sea" to the German Ocean, from the fact that winds blowing from that quarter were apt to bring fog and gloom. But if the south wind was little admired in the Elizabethan days, the northern wind fared no better. Shakespeare would not have committed himself by writing an ode like that perpetrated by Kingsley. The longing which some people in these days profess for a good old-fashioned winter, and the opinion of the "bracing" character of a north-easter, are, we suspect, notions of somewhat modern origin, and are often chimney-corner aspirations, about as real as Jamie Thompson's praises of early rising. Shakespeare shows no love for winter:

"You and you are sure together
As the winter to foul weather."
As You Like It, V., 7.

It is only luxurious ages and persons who can expose themselves to the weather only when and how they like, and come in to a comfortable home when sufficiently "braced," who can like winter.

The opinion is often expressed that the climate of these islands, and indeed of western Europe altogether, has undergone a change for the worse during the last two or three centuries. Even if our average temperature has not decreased, or our mean rain-fall—or rather number of wet days—been augmented, we have, men say, a less prospect of warmth, and dryness, and calm coming when they are wanted,—that is, from the blooming of the wheat to the ingathering of the various crops. True, we have had, since 1870, great store of unseasonable weather, among which 1879 holds a memorably evil pre-eminence. But let us listen to the following passage:

"Therefore the winds, piping to us in vain,
As in revenge, have sucked up from the sea
Contagious fogs; which falling on the land
Have every pelting river made so proud
That they have overborne their continents;
The ox hath therefore stretched his yoke in vain,
The ploughman lost his sweat, and the green corn
Hath rotted ere its youth attained a beard.
The fold stands empty in the drowned field,
And crows are fatted with the murrain flock.
The nine men's morris is filled up with mud,
And the quaint mazes in the wanton green,
For lack of tread are undistinguishable.
The human mortals want their winter cheer,
No night is now with hymn or carol blest;
Therefore the moon, the governess of floods,
Pale in her anger, washes all the air
That rheumatic diseases do abound.
And through this distemperature we see
The seasons alter; hoary-headed frosts
Fall in the fresh lap of the crimson rose;
And on old Hyem's chin and icy crown
An od'rous chaplet of sweet summer buds
Is as in mockery set. The spring, the summer,
The chiding autumn, angry winter change
Their wonted liveries, and th' amazed world
By their inverse now knows not which is which."
Midsummer Night's Dream, Act II., Sc. 2.

Is this mere imaginary descripti n? We should say that it is a most faithful picture of such a season as that of 1879, with all its distressing features. We have summer frosts, short fits of mild weather coming when cold would be more seasonable, overflowing rivers, fields swamped, sheep perishing of foot-rot and of "flukes" in the liver, the corn rotting before it can reach maturity, the field-paths becoming indistinguishable because impassable. It is, in short, 1879 to the life, as any faithful observer—especially if living in a rural district—would have found it, and no one could have given its sad characters at once so strikingly and yet so briefly. We see, then, that cold wet summers are not a misfortune peculiar to the nineteenth century. A glacial epoch may be returning, but "cruel 1879" is no proof that such is to be the doom of our immediate posterity.

The appearance of the sky at sun rising has always been considered an indication of the weather that is to follow. Proverbs in common use in France and Germany, as well as in Britain, warn us against a red sky in the morning. Shakespeare was no stranger to this view, which does not always hold good.

> "As doth the blushing discontented sun
> From out the fiery portal of the east,
> When he perceives the envious clouds are bent
> To dim his glory, and to stain the track
> Of his bright passage to the occident."
>
> *Richard II.*, Act III., Sc. 3.

Here we have a picture of a particular type of unpromising morning, which every observer of the weather must have observed, and which was but too common both in 1879 and in 1882, The sun rises "blushing"—*i. e.*, red—into a tract of clear, fiery sky, beyond which lies a dense bank of clouds, which maintain their position and thicken till the whole sky is overcast, and the rain sets in.

Another red dawn is described, as on the day of the battle of Shrewsbury:

> "How bloodily the sun begins to peer
> Above yon busky hill! The day looks pale
> At his distemperature.
> The southern wind
> Doth play the trumpet to his purposes,
> And by his hollow whistling in the leaves
> Foretells a tempest and a blust'ring day."
>
> *Henry IV., Part I.*, Act V., Sc. 1.

Here, in addition to a red dawn, we have another indication of rain drawn from the peculiar character of the wind. In various rural districts we have heard a "bustling wind" spoken of as a sure sign of rain, and, as far as our observations have gone, it has invariably proved correct. The wind is by no means violent; it does not seem to move the stems or the larger branches of trees or shrubs, but it causes a great commotion in the leaves, especially if these are broad.

It is, perhaps, curious that in the writings of Shakespeare we find no reference to the sunset as an augury for the day to come. Nor is the rainbow mentioned, concerning the signification of which there exist not a few contradictory proverbs. All, we think, agree that a rainbow in the morning is a bad sign. But the English countryman is apt to regard—

"A rainbow at night
As the shepherd's delight."

The French peasant, on the contrary, says, more wisely, as we think:

"Arc en ciel du soir
Il faut voir."

Certainly in settled fair weather rainbows, either at morning or night, are not likely to make their appearance.

The cry of the owl seems to have been held as characteristic of stormy weather:

"The obscure bird
Clamoured the live-long night."
Macbeth, Act II., Sc. 5.

It may be doubted whether this circumstance is mentioned as characteristic of stormy weather, or as an omen that mischief of other kinds was about. We have never met with any popular saying which connected the voice of the owl with rain and storm, nor have we observed it to be a "weather-wise" bird. The notion that its hooting is a sign of death has been common for centuries. Some wise man attempted to explain this supposed fact by the assumption that the owl smells the approach of death in a sick man, and flutters screaming round his house in an effort to get at the body. This is a curious collection of blunders. The owl prefers, like a true sportsman, to kill game for its own dinner, and does not care for a prey which has died a natural death. Secondly, the bird has, by no means, a very acute sense of smell, and would be utterly unable to detect the odour of a dead or dying man outside the house. She is very possibly attracted by a light in the sick chamber, and puzzled thereby, as are sea-fowl by a light-house, flutters around instead of attending to her lawful business.

The notion of the unwholesomeness of the night air must have been already current in Shakespeare's time. We read:

"To dare the vile contagion of the night,
And tempt the rheumy and unpurged air."
Julius Cæsar, Act II., Sc. 3.

It is indisputable that in malarious districts the night air is especially dangerous. But it may well be doubted if the extreme dread of the night air common in England is anything more than a superstition. There are many people who—whatever may be the temperature, and how dry and calm soever the weather—would be horrified at sleeping with their bed-room windows open. It has hap-

pened to us more than once, when on a visit at friend's house, to find that during dinner the servants had carefully shut the windows, and thus secured—for us at least—the luxury of a restless night. Perhaps in Shakespeare's day malaria might have been more common than in the present time, and to shun the night air was therefore good policy. There are even yet districts in England where we should not prefer to sleep with open windows in an autumn night.

To conclude these somewhat random remarks we will quote a very faithful description of the hush which often precedes a storm:

> "But as we often see against some storm
> A silence in the heavens, the rack stand still,
> The bold winds speechless, and the orb below
> As hush as death; anon the dreadful thunder
> Doth rend the region."
>
> *Hamlet*, Act II., Sc. 7.

This passage, like the account of the wet season which we cited above, is evidently the fruit of personal observation, and not of tradition.—*London Journal of Science.*

REPORT FROM OBSERVATIONS TAKEN AT CENTRAL STATION, WASHBURN COLLEGE, TOPEKA, KANSAS.

BY PROF. J. T. LOVEWELL, DIRECTOR.

The weather in the first decade of this report was characterized by extreme cloudiness although the precipitation was small. During the last two decades the mean temperature has been much lower.

A very cold period began on the 17th which reached its culmination on the 21st, when the low temperature of—21° was recorded. The most disagreeable day to be out was the 20th, the temperature not rising above zero the entire day and a strong north wind prevailing.

A snow storm on the 15th brought four and a half inches of snow which gave a week of tolerable sleighing.

On the evening of the 18th a brilliant lunar halo was observed, the Moon being near the zenith and both a primary and a secondary arc were visible for nearly 180° on the south side of the Moon. The former was about 50° from the Moon and the prismatic colors well defined. The secondary arc was about 20° from the Moon and fainter—the prismatic colors being wanting.

The usual summary by decades is given below.

TEMPERATURE OF THE AIR.	Dec. 20th to 30th.	Jan. 1st to 10th.	Jan. 10th to 20th.	Mean.
MIN. AND MAX. AVERAGES.				
Min	18.2	2.1	4.5	8.3
Max	38.0	31.5	28.7	32.7
Min. and Max	28.1	16.8	16.6	20.5
Range	19.8	29.9	24.2	24.6
TRI-DAILY OBSERVATIONS.				
7 a. m.	22.5	7.2	8.2	12.6
2 p. m.	28.4	22.2	25.0	25 2
9 p. m.	24 1	14.3	15.3	17.9
Mean	24.8	18 5	16.8	20.0
RELATIVE HUMIDITY.				
7. a. m.	. .	. .	. .	. .
2 p. m.	. .	. .	. .	. .
9 p. m.	. .	. .	. .	. .
Mean	. .	. .	. .	. .
PRESSURE AS OBSERVED.				
7 a. m.	29.09	29.21	29.13	29.14
2 p. m.	29.09	29.14	29 08	29 10
9 p. m.	29.11	29.21	29.14	29.15
Mean	29.10	29.19	29.12	29.13
MILES PER HOUR OF WIND.				
7 a. m.	13.8	.	. .	. .
2 p. m.	12.2	. .	. .	. .
9 p. m.	11.6	. .	. .	. .
Total miles	2539	3071	4995	10605
CLOUDING BY TENTHS.				
7 a. m.	7.6	3.1	3.4	4.7
2 p. m.	4.9	2.3	2.1	3.1
9 p. m.	3.4	3.0	4.0	3 5
RAIN.				
Inches	.10	.00	.53	63

ASTRONOMY.

THE STARS FOR FEBRUARY.

The northern heavens present no change of special importance since last month. The Dragon has been carried away from his former *hovering* position, and now appears as if swooping downward, though in a direction contrary to that of his real motion around the pole. The ancient observers do not seem to have attached any importance, by the way, to the direction in which the star-sphere turns; and indeed, a motion so slow as not to be perceptible by ordinary vision might well be left out of account in forming imaginary star-groups. Some of the figures go forward, as Orion, the Great Bear, Bōōtes (the Herdsman), the Lion, and so forth; others go backward, as the Dragon, the Ram, the Bull, Pegasus (the Winged Horse), and so on; while others, like Ophiuchus (the Serpent bearer), are supposed to face the observer and so travel sideways; and others again, travel on their head, as Hercules, Cepheus, and Andromeda. It is quite clear that those

who invented the constellation figures did not trouble themselves much about the rotation of the star-vault.

There may be noticed in the northern heavens, as seen in February, a vacant space above the pole, girt round by the constellations Auriga (the Charioteer) overhead, Perseus (the Rescuer), Cassiopeia (the Seated Lady), Cepheus (her royal husband) and the two Bears. In this poverty-stricken region there are no stars of the first three magnitudes, and only four or five of the fourth magnitude. The ancient astronomers could imagine no constellations in these spaces. It is to the moderns, and especially to Hevelius, that we owe the constellations which have been figured in these barren districts. The Camelopard, or Giraffe, is one, the Lynx another. I cannot say, for my part, that I see either a giraffe or a lynx there. Certainly, if you draw the connecting lines shown in the map, you get as fair a picture of a giraffe (inverted at present) as can possibly be made with a couple of lines; but it seems to me—though I do not claim to be an artist—that rather more than two lines are needed to picture a respectable giraffe. Besides the lines are not on the sky, and the liveliest fancy would not think of connecting these stars by imaginary lines, so widely remote are the stars, and so insignificant.

The Little Bear is now gradually getting round (at the selected hour of evening observation) to a position such as a bear might reasonably assume. Last month, this small bear was hanging head downward by the end of his absurdly long tail. He is now slowly rising from that undignified position, and by next month he will have fairly placed himself on his feet. For the present we can leave him to his struggles; but next month we shall consider his history and the duties which he has discharged for many hundreds of years.

Turning to the southern skies, we find full compensation for the relatively uninteresting aspect of the northern heavens. The most resplendent constellation in the heavens is now in full glory in the south. There, close to the meridian, or mid-south,

> "Begirt with many a blazing star,
> Stands the great giant Algebar,
> Orion, hunter of the beast:
> His sword hangs gleaming by his side,
> And on his arm the lion's hide
> Scatters across the midnight air
> The golden radiance of its hair."

No one can mistake this most beautiful constellation. The two bright shoulder stars, Betelgeux (*alpha*) and Bellatrix (*gamma*), the brilliant star Rigel on the giant's advanced foot, the triply gemmed belt (*zeta*, *epsilon*, and *delta*), and the pendent sword tipped with the bright star (*iota*), distinguish Orion unmistakably. But, besides these glories, there are others; the curve of small stars forming the giant's shield (a lion's hide), the misty light of the great nebula which lies on the sword (where shown), and on clear nights the dappled light of the

Milky Way, which really extends over a part of this constellation, to say nothing of numbers of faint stars scattered all over it, justify the words of the poet, who sang:

"Orion's beams! Orion's beams!
His star-gemmed belt, and shining blade;
His isles of light, his silvery streams,
And gloomy gulf of mystic shade."

From the beginning of astronomy, and probably long before astronomy was thought of, this constellation was figured as a giant: sometimes a giant hunter, a sort of celestial Nimrod; sometimes as a warrior. He commonly wields an immense club in his right hand, and a shield in his left. The star *Beta* of the constellation Eridanus really marks the giant's bent knee; and originally the constellation Lepus, or "the Hare," formed a chariot in which the hunter or warrior stood. In some old manuscripts of the Middle Ages, the stars of Lepus formed a throne for Orion. In fact, this little constellation, although named the Hare from time immemorial, has been called by other names, insomuch that Ideler, after quoting several, wrathfully adds, "And God knows how many more there are."

Orion is somewhat out of drawing, because of the necessity of keeping certain stars in particular positions with respect to him. Thus Betelgeux is derived from the Arabic *ibt-al-jauzá*, the giant's shoulder; Bellatrix, or "the Amazon star," belongs of right to the other shoulder, and Rigel to the advanced foot, while the three stars of the belt fix the position of the giant's waist. To tell the truth, he is an ill-shaped giant, anyway, and cannot be otherwise depicted.

Below Lepus (the Hare) you see the neat little group Columba, or "the Dove." This is one of the younger constellations, and was invented by Hevelius, perhaps to show that the ship Argo, which you see low down on the left, is no other than Noah's Ark. In fact, the name given to the small group originally was Columba Noachi, or "Noah's Dove." Approaching the mid south, you now see the brightest star in the whole heavens—Sirius, the famous Dog-star. The constellation Canis Major (the Greater Dog) which might much better be called simply Canis, was one of Orion's hunting dogs, Canis Minor being the other; but we can hardly suppose Lepus was the sole prey pursued by so great a giant and two such fine dogs. The constellation Canis Major is chiefly remarkable for the Dog-star. In old times this star was thought to bring pestilence. Homer speaks of it (not by name, however) as the star

"Whose burning breath
Taints the red air with fevers, plagues and death."

Many among the ancients supposed that this star was in reality as large as the Sun. Thus Manilius said:

"'T is strongly credited this owns a light
And runs a course not than the Sun's less bright;
But that, removed from sight so great a way,
It seems to cast a dim and weaker ray."

It has been shown in our own time, however, that even this estimate, which was by many thought too daring, falls far short of the truth. It has been calculated that Sirius gives out two hundred times as much light (and doubtless two hundred times as much heat) as our Sun. So that it would make us rather uncomfortable if our Sun were removed and Sirius set in its place. Sir W. Herschel says that when he turned his large four-foot mirror on this star, the light was like that of the rising Sun, and it was impossible to look at the star without pain to the eye. Sirius is in reality in rapid motion, though owing to his enormous distance he seems at rest. He is rushing through space at the rate of about thirty miles in every second of time! In a year he traverses nearly six times the distance which separates our Earth from the Sun. This enormous annual journey is only about $\frac{1}{170000}$th part of the distance which separates him from our Earth; and as he is traveling away from us, we need not be greatly troubled on account of him. He is so far from us that his light has been no less than twenty years on its way to us, so that in reality, instead of saying we see Sirius, we ought to say we see where Sirius *was* some twenty years ago. Most of the stars are even farther away, so that if every one of them were in a single instant destroyed, we should still see them—that is, their light—for many years, and probably the greater number of them would still seem to be shining in the heavens long after the youngest of us were dead; perhaps even after our great grandchildren had passed away.

Canis Minor (the Lesser Dog) is a much less important star group than Canis Major, but still it is one of the ancient constellations. Its chief star is call Procyon, or "the Fore-dog," because his star is seen as a morning star earlier than Sirius. The Arabian astronomers gave it a name of similar meaning, to-wit, *Al-kelb-al-mutckaddem;* but I think Procyon sounds almost as well, and as it is the name by which the star is usually called, it may, perhaps be better to use it instead of the Arabian name, though this is very pretty. Procyon, like Sirius, was supposed to be a star of evil omen, especially as bringing bad weather. "What meteoroscoper," said Leonard Digges, the astrologer, "yea, who that is learned in matters astronomical, noteth not the great effects at the rising of the star called the *Litel Dogge?*"

The constellation Gemini, or the Twins, is now approaching the south, but will be more fully within the range of next our monthly map. The sign marked ♋ is that of Cancer, or the Crab which the Sun enters at mid-summer. You will observe that we have now reached the part of the ecliptic highest above the equator, which is, of course, the part reached by the Sun at midsummer. The point marked ♋ is at its highest in the south at noon on or about June 21st, and is then occupied by the Sun; it is at its highest in the south at midnight on or about December 20th, and the Sun is then exactly opposite to this point, or at his lowest below the northern horizon.

Those who live as far south as New Orleans, see, well raised above the horizon, the star Canopus, in the stern of the good ship Argo. There is presented to them, at this season, a view of more first magnitude stars than can be seen at

any other time in one quarter of the heavens. For besides the splendid equal-sided triangle formed by Procyon, Betelgeux, and Sirius, they see Aldebaran, Rigel, and Canopus, the last-named surpassing every star in the heavens except Sirius alone.

Next month, the great ship Argo will have come better into view; and I defer till then my account of this fine constellation.

The eastern and western maps for this month, when compared with those for January, show how the stars, observed at any given hour month after month, change in position just as though they were watched hour after hour on the same night. Thus in the January eastern map the Lion is seen low down, and the arrows scattered over the map, which (except the arrow on the ecliptic) point the way the stars are apparently moving, show that the Lion is passing upward and slightly toward the right, or to just such a position as the constellation has in the eastern map for this month. In fact, if the stars had been observed in January two hours after the time when the Lion was placed as shown in the January map, it would have been found that the Lion had reached the exact position occupied by the constellation in our present map. Two hours' motion on any given night produces the same change of position as one month's motion for stars seen at any given hour. This remark applies to all stars; and the young student will do well to compare together the two eastern maps and the two western maps (for January and February), following up the work by noting month after month how the star groups rise up from out of the eastern horizon, and pass down toward the western. Also he will find it interesting to notice how six months hence the stars which are now rising at any given hour in the east will be found at the same hour setting in the west; while those which at any hour are now setting in the west will be found six months hence rising in the east. What is true of the present time, and six months from the present time, is true of any part of the year, and six months before or after that time.

In the east we see that at the hours named under the map (and of course at intermediate hours on the intermediate dates) the constellation Auriga has passed overhead, leaving only two stars visible in the space covered by the map, and even those two (*Beta* and *Theta*) have passed over to the western side of the north and south line overhead. The Lion is now the chief constellation of the east; and the student will do well to study it there, for this group is not so well seen at any other part of the year. When in the south, indeed, it is better placed for the astronomer, who cannot have the stars too high above the horizon. But the general student of the skies can note the shape of star groups more conveniently when they are at a moderate elevation.

I think few can recognize in the constellation Leo, as now figured, the shape of a lion. The stars *Mu*, *Epsilon*, and *Lambda* now mark the place of the lion's head, while his tail ends at the star *Beta*, and his forepaws reach from *Pi* to *Omicron*. It requires a strong imagination to see a lion among these stars. But I think a much larger lion can be readily seen, the head lying in Cancer, the mane reaching to Leo Minor, the forepaws on the stars *Zeta*, *Epsilon*, and *Delta*, which

mark the head of Hydra (the Sea-Serpent), and the hinder paws on the stars *Be'a* and *Zeta* of Virgo. It seems to me likely that originally the constellations named after men, animals, and other objects, were not, as now, separated from each other; but that if any group, large or small, seemed to resemble any object it was named after that object, whether it formed part or not of any other group already named, or whether it included part of such a group or was itself partly included in another constellation.

Of Virgo, which is just beginning to rise above the horizon, I shall have more to say next month.

In the west Pegasus, which was nearly in full view last month, has almost wholly set. Andromeda (still head downward) is following the Winged-Horse, but not toward the same part of the horizon. Perseus, or "the Rescuer," who was overhead last month, now lies between Andromeda and the point overhead, while Auriga (the Charioteer) now occupies the highest region in the heavens.

Two interesting constellations, which last month could not be seen in the western map, have now passed within its precincts, namely, Taurus (the Bull), and Cetus (the Sea Monster or whale).

It is very easy to identify the Bull, first by the Pleiads, and, secondly, by the bright and somewhat ruddy Aldebaran. The famous cluster—the so-called *seven* Pleiads—in reality contains an immense number of stars, forming a very beautiful and amazing object when examined even with a small telescope. It is fabled that there were once seven Pleiads visible to the naked eye, but that one, called the lost Pleiad, has faded from view. With good eye-sight, however, not only can the original seven Pleiads be distinctly seen, but several others. A few observers have even seen as many as fourteen Pleiads.

The star (*Omicron*) Ceti is perhaps the most interesting star in the heavens. It is shown, in the map, of the second magnitude, but is in reality variable. At its brightest it shines as a star of the second magnitude; but it only shines thus for about two months out of ten. For about a fortnight it shines as a star of the second magnitude, then by degrees it fades away, until at the end of three months it can hardly be seen. After remaining about five months invisible, it gradually increases in brightness for about three months when it is again a second magnitude star. It occupies about 331 days and eight hours in going through these changes. —*Easy Star Lessons.*

GEOLOGY.

GEOLOGICAL SURVEYS OF KANSAS AND MISSOURI.

In the Legislatures of both of the above named States bills have been introduced providing for geological surveys of the respective States. We give the full text of that for Kansas, sent us by Mr. Geo. S. Chase, Chairman of the Committee appointed by the Kansas Academy of Science to attend to the matter:

Be it Enacted by the Legislature of the State of Kansas:

SECTION 1. That the Governor, Attorney-General, and President of the Kansas Academy of Science are hereby constituted a Board of Commissioners who are authorized and required, as early as may be, after the passage of this Act to appoint and commission a competent geologist for the purpose of organizing and prosecuting a geological survey of the State.

SEC. 2. Said geologist shall be authorized to appoint and associate with him a competent assistant geologist and palæontologist and an experienced analytical and experimental chemist and mineralogist, and such other collaborators and assistants as the best interests of the work may from time to time demand, provided the compensation for such assistance does not exceed the sum hereinafter appropriated for the maintenance of the survey; the appointment, direction and dismissal of assistants connected with the survey to rest in the hands of the geologist in charge.

SEC. 3. The objects and methods of the survey are the acquisition of a comprehensive and detail knowledge of the geological structure and mineral resources of the territory embraced within the limits of the State. This shall include besides a careful study of the superficial reliefs of the State from such data as is or may be accessible, a thorough investigation of the stratigraphy of the various geological formations occurring within its bounds with the view of ascertaining their constitution, magnitude, and distribution, and the character, extent and value of the mineral or other products of economic importance occurring in connection with such formations. In view of the necessities for the realizations of the largest scientific and practical results in the prosecution of these investigations the work of the geological survey shall be proceeded with systematically, and with as great energy and despatch as may be consistent with its efficient execution. For this purpose the State shall be divided into at least three divisions, which shall correspond with the three principal hydrographic basins occurring within its limits, viz: The Missouri, Kansas and Arkansas drainage systems. These systems to receive a careful preliminary examination in order to determine

the salient, physical and geological features pertaining to each division and to the whole State. With the consummation of these preliminary exploration the detail investigation of these divisions shall be begun, commencing with the oldest geological formation, and expanding the work by the detail survey of each county until the whole territory of the State shall have been thus systematically explored. For the greater expedition of this work the geologists shall further devote their investigations to special formations and districts, as far as may be, thereby allowing the examinations to be carried on in all parts of the State at one and the same time.

SEC. 4. It shall be the duty of said geologist in charge to make as complete a series of examinations of the superficial geological deposits as shall aid to an understanding of the origin, character, and extent of the different sorts of soils, the probability of obtaining water by means of artesian wells, especially in the western counties; also of all rock exposures, coal-beds and other mineral deposits as practicable, and the information thus gained shall be embodied in such notes, diagrams and sections as may be necessary for the clearer elucidation of the local, structural and stratigraphical features of the geological formations occurring in each county, and over the entire State.

Said geologist shall also secure as complete collections as possible of the minerals, rocks, soils, fossils, salines, and mineral waters occurring in the State that in any way have a value as aids to a thorough knowledge of its geological history.

A complete suite of said collections to be retained in the museum of the Kansas Academy of Science at the Capitol where they shall be classified and arranged, and be a permanent exhibition of the geological survey; a full series of the duplicate specimens similarly classified and authenticated to be placed at the disposition of the State University, State Agricultural College, and State Normal Schools. The geologist in charge shall also be authorized to use every means in his power, not otherwise interfering with the efficient conduct of the survey, to make accessions from abroad of geological material to the collections of the survey that may in any way contribute to the value of the economic, and educational results of the same.

SEC. 5. The said geologist in charge shall cause to be submitted to the chemist all ores, minerals, rocks, soils, salines, and mineral waters the chemical investigation of which may be of economic and scientific utility; also the chemist shall be afforded practical facilities for the prosecution of researches in the field wherever such may be essential to the interest of knowledge or of practical utility: and he shall in all cases be required to report the results of his analyses and investigations to said geologist.

SEC. 6. It shall be the duty of said geologist in charge to submit to the Governor on or before the first Monday in January of each year, a concise report of progress of the field-work for the current year in which the more important economic results shall be made public.

SEC. 7. At the earliest practicable date the geologist in charge shall prepare

reports on the regional or county geology including reports of assistant geologist and chemist, each county so described to be accompanied by diagrams, sections and a map on which shall be indicated the location of all important mineral deposits the existence of which shall have been made known, and as far as practicable the extent of forest and prairie, nature and distribution of soils, and such other occurrences as may be deemed of importance for the information they afford regarding the economic resources, and industries dependent thereon, and the general aspect of the counties of the State. Said reports shall be placed in the hands of the Governor, who shall bring them to the attention of the Legislature at its earliest session thereafter with recommendation for their speedy publication.

SEC. 8. On the completion of the field-work of the survey the geologist in charge shall make and cause to be made final reports on the geology of the whole State, including reports of the assistant geologist, chemist and collaborators of the survey, which shall embrace discussions of the physical, geological and mineralogical features of the entire area of the State, and its relations in these respects to contiguous regions; said reports shall be accompanied by charts, diagrams, and other necessary illustrations, vertical and profile sections embracing generalized presentations of the stratigraphy and valuable minerals associated with the geological formations present in various parts of the State, and a large sized map of the State on which shall be indicated by colors, and other appropriate means the extent of surface occupied by the various geological formations occurring within its bounds; in fine, such reports shall present a full digest of the scientific and economic results attained during the prosecution of the survey, together with such other relevant matter relating to the more complete exposition of the geological history of the State as may be available. And on the completion of such reports the said geologist shall transmit the same to the Governor who shall cause them to be laid before the Legislature with recommendation for their suitable publication. The said geologist shall have the supervision of the preparation and publishing of all reports emanating from the survey.

SEC. 9. The salary of the geologist in charge shall $2,000 per annum. The salaries of the assistant geologist and chemist not to exceed $1,200 per annum each. For the services of specialists, local assistants and other persons temporarily employed on the survey the compensation shall not be greater than that ordinarily paid for similar services.

SEC. 10. In order practically to carry out the provisions of the foregoing sections of this Act the sum of $10,000 is hereby annually appropriated for the term of two years, out of such monies remaining in the treasury as are not otherwise appropriated.

This fund shall be drawn as required for the purposes of the survey on requisitions signed by the geologist in charge approved by the Governor, and the warrant of the Auditor of State, and the Auditor is authorized to issue his warrants upon the Treasurer for the sums named in such requisition.

The Bill introduced in the Missouri Legislature is similar in most respects, as the abstract below, sent us by Prof. Broadhead, will show.

The Governor appoints a board of four persons, himself Ex-Officio member and President of board. They shall appoint a State Geologist, who is not connected with or under influence of any school. State Geologist to appoint his assistants and have power to remove them—Governor and Board may remove State Geologist. State Geologist and assistants to make surveys, maps and reports of work, and also may have power from time to time to issue bulletins of work done; also to furnish newspapers with items—provided it does not interfere with other work. State Geologist also has power to furnish duplicate sets of specimens to museums within the State—provided the expense of fixing up and labelling such is paid for by the museum or persons conducting the same, and also provided such work does not interfere with the progress of the survey and that the State collection is not deprived of necessary duplicates. Bill provides for a State museum and headquarters to be, if possible, at the Capitol of the State, otherwise to be where quarters can be best obtained. Headquarters to be at Jefferson City. Reports to be made to each General Assembly of progress, condition and expenses. Has authority to take possession of all matter belonging to former surveys, but does not give power to take possession of any cabinet of specimens already in place.

Salary of geologist $3,000 per year; assistants $1,800 and $1,500, and no others over $5 per day. Board only receive their necessary expenses, when in attendance. Gives power to employ a palæontologist if necessary; also to negotiate for chemical work. Amendments to this give chemical work to School of mines. $15,000 annually appropriated.

BOOK NOTICES.

HOUSE-DRAINAGE AND SANITARY PLUMBING. By Wm. Paul Gerhard; pp. 205, 18mo. D. VanNostrand, New York, 1882. 50c.

This is No. 63 of VanNostrand's "Science Series," and is an exceedingly well written and useful essay. A general idea of the author's style and manner of handling the subject may be gained from the article on "Sewer Gas and its Danger to Health," on page 571 of this issue of the REVIEW, which is copied from the first chapter of the work. The other topics treated are mainly as follows: Defective and Good Plumbing work; Essential Elements of a System of Plumbing; Soil and Waste Pipes; Traps; Absorption of Gases; Drainage of Cellars; System of House-Drainage; Bath and Laundry Tubs; Sinks; Water Closets; Flushing Appliances, etc.

This small volume contains much common-sense information and instruction, and might well be studied by engineers and architects as well as property owners who intend to build.

THE LOWEST FORMS OF WATER ANIMALS. By N. D' Anvers. Square 16mo. pp. 59. Illustrated. G. P. Putnam's Sons, New York, 1882. For sale by M. H. Dickinson, 50c.

This is No. V of the Science Ladders, those preceding it being Forms of Land and Water; A Story of Early Exploration; Vegetable Life; Flowerless Plants.

The volume under consideration takes up in simple style the discussion of the subject of the lowest forms of water animals by defining what an animal is; what protoplasm is; then the successive forms of such animals; the Rhizopoda; Sponges; some forms of Infusoria; the life of a Hydra and a Medusa; Sea Anemones and how they live; Coral-Makers and how they grow; some of the Polyzoa; some tiny creatures with water-works, and closes with a series of questions to test the young reader's memory and comprehension.

Mr. D' Anvers aims to teach the great laws of nature in language simple enough to be intelligible to the youngest readers and to awaken in them the habit of observation and reasoning. In these objects he is sure to succeed so far as he has readers.

MILITARY LIFE IN ITALY. By Edward De Amicis: with illustrations; 8vo., pp. 440. G. P. Putnam's Sons, New York, 1882. For sale by M. H. Dickinson, $2.00.

All of De Amicis' works are full of enthusiasm and spirit, and this one is no exception to the rule. In addition to this feature these sketches carry with them a lesson of inspiration and consolation to the soldier and of admiration and esteem for him to the civilian. Every side of human nature is skillfully depicted in them, the serious as well as the comic, and no reader will regret spending a few hours in perusing the book. Among the best of the sketches are The Conscript, The Son of the Regiment, and Dead upon the Field of Battle.

HOW TO SUCCEED. Edited by Lyman Abbott, D.D. Square 16mo, pp. 131. G. P. Putnam's Sons, New York, 1882. For sale by M. H. Dickinson, 50c.

The readers of the *Christian Union* have already seen most of the essays in this admirable collection, but for the benefit of those who have not we will say that the book is No. XXVI of the Handy Book Series, and is made up of a number of essays on "How to Succeed" by some of the most able and practical men of this country in their several departments of labor.

Hon. T. F. Bayard and Hon. Geo. F. Edwards write upon How to Succeed in Public Life; Rev. John Hall, D.D., gives advice How to Succeed as a Minister; Willard Parker, M. D., tells How to Succeed as a Physician; Gen'l Wm. Sooy Smith, How to Succeed as a Civil Engineer; Wm. Hamilton Gibson, How to Succeed as an Artist; a New York merchant anonymously gives rules for succeeding in Mercantile Life; Lawson Valentine, How to Succeed in Business

Life; Leopold Damrosch, How to Succeed as a Musician; Hon. Geo. B. Loring, as a Farmer; Thomas A. Edison, as an Inventor; Rev. E. P. Roe, in Literature; while Rev. Lyman Abbott gives his views upon the Christian conditions of success.

Nearly all occupations are thus touched upon by men who have had practical experience and who are living examples of the practice they preach, and these essays, whether read by the young or by those interested in their welfare, must have a beneficial effect.

EASY STAR LESSONS. By R. A. Proctor. Crown octavo, pp. 239, illustrated. G. P. Putnam's Sons, New York, 1882. $2.50

The popularizing of knowledge seems to have been the special work of scientific men within the past twenty years, and of the many contributors in this direction none has done more or done it better than Mr. Proctor. Though but a comparatively young man he has achieved a world-wide reputation as profoundly skilled in more branches of science than one, although he is mainly regarded as an astronomer.

The above named book is his latest production, and his publishers have evidently striven by the exercise of the best taste and the use of the choicest materials in the book-maker's art to make it worthy. Paper, print and binding are superb, and the illustrations, including forty-eight star-maps and thirty other engravings, are admirable in execution and thoroughly practical. To the stars of each month in the year is devoted a chapter and four maps showing the proper position of each constellation and the prominent stars in the northern, southern, eastern and western skies for that month So interesting and so unusually plain and practical are these descriptions, even without the maps, that we give on page 586 the whole chapter on "The Stars for February." By a careful use of it, the reader may pick out the constellations with little trouble, while by the additional use of the maps the whole sky may be read like a printed book.

THE ODYSSEY OF HOMER. Done into English prose by S. H. Butcher, M. A., and A. Lang M. A. 12mo., pp. 427. Macmillan & Co., New York, 1882. Price $1.00.

The translators in the preface to this work, claim that there can be no final English translation of Homer from the fact that the taste of each successive generation differs regarding poetical style, whether versified or not, from all preceding periods. Thus, in the Elizabethan age Chapman modified the antique simplicity of Homer to suit its peculiar requirements, and rendered the poem in high sounding and luxurious conceits which would in no respect satisfy the more fastidious tastes catered to by the elegant Pope in Queen Anne's time. Later, when the ballad collectors of Europe were forming the tastes of the people, Homer was regarded a ballad minstrel, and his poems rendered by Maginn, Gladstone,

and others with the simplicity and baldness of the verses of the minnesingers. Still later the romantic vein was discovered and worked with marked success by Mr. Worsley, who made an admirable translation of the Odyssey, in which "the liquid lapses of the verse, the wonderful closeness to the original, reproduce all of Homer in music and in meaning that can be rendered in English verse."

The object of this prose translation is to supply a demand now existing for simple descriptive or historical documents, without modern ornament and with nothing added or omitted, a thing with which poetry, or, at least verse, is almost incompatible.

The work of the translators, looked at from this standpoint, seems well done, and the prose form certainly gives a better opportunity than verse for a close adherence to the Homeric language and style. To those readers who want a strictly reliable, scholarly rendering of the story in "unadorned English," nothing can be more satisfactory.

FRONTIER ARMY SKETCHES. By James W. Steele. 12mo., pp. 329. Jansen, McClurg & Co., Chicago, 1883. $1.50.

That these "Sketches" are the work of an observant, sympathetic, cultured man who has actual and practical experience of the pleasures, hardships, excitements and inexpressible tedium of frontier military life is self-evident. His correct and just appreciation of the West Point graduate, whom he portrays under the title of Captain Jinks, his abhorrent and overpowering disgust for and detestation of the cruel and treacherous Indian of the plains, his perfect delineations of western character, good and bad; his skillful command of language, his expressive grouping of words and his forcible and graceful sentences, all betray an excellent education and cultivated tastes, as well as a military training.

Every one of these sketches is a model of good literary style, and most of them are exceedingly real, piquant, lifelike, and dramatic. They remind one of Theodore Winthrop in many respects, and are far superior in all respects to Bret Hart.

THE COURT AND CROSS. By W. J. Henry. Octavo, pp. 568. Methodist Book Concern, Cincinnati, 1882.

The object of this work, whose author is a lawyer of this city, is set forth in the preface as being to present the principal events of Christ's wonderful career in their relation to the Sanhedrin or great court of the Jews; also to portray his life as it was affected by the views, actions and deliberations of that influential body, as well as to bring vividly before the mind the times, places and conditions of the Jewish nation; also a description of the principal, political, judicial and ecclesiastical tribunal, the council or great court of the Jews, into which the author has attempted to carry the reader in imagination and give him a probable statement of the arguments and views of its members upon the case before them.

Further it is attempted by the author to combat the views of those who doubt the Divinity of Christ, the authenticity of his miracles and the truth of his doctrines.

In carrying out this plan Judge Henry has shown great skill in bringing together historical facts bearing upon the case, while his legal acumen has been of the greatest service in arranging the argumentative portion of the work. It will be found decidedly interesting to all classes of readers, not only for these reasons, but because the author has left the beaten track and taken up a line of thought and argument not heretofore presented so far as we know.

OTHER PUBLICATIONS RECEIVED.

The *New York Medical Journal*, Vol. XXXVII, Nos. 1 and 2, quarto, weekly, pp. 28, edited by Frank P. Foster, M. D., published by D. Appleton & Co., N. Y., $5 00. *The Electrician*, Vol. II, No. 1, quarto, Williams & Co., New York, editors and publishers, monthly, $1.00 per annum. *The Wheelman*, Vol. I, No. 4, Jan'y, 1883, octavo, pp. 80, illustrated, edited by S. S. McClure, published by the Wheelman Co., Boston, monthly, $2.00. *Carboniferous Rocks of Eastern Kansas*, G. C. Broadhead, reprinted from Proceedings of St. Louis Academy of Sciences, pp. 12. *Review of the Telegraph and Telephone*, Vol. I, No. 22, quarto, pp. 16, edited and published by Geo. Worthington, N. Y., semi-monthly, $2.00. Bulletins of the *American Museum of Natural History*, Vol. I, Nos. 2 and 3. Fifteenth Annual Report of *Peabody Museum* of American Archæology and Ethnology, Vol. III, No. 2, F. W. Putnam, Curator. New York *Medical Record*, Vol XXII, No. 26, octavo, pp. 28, weekly, edited by Geo. F. Shrady, M. D., and published by Wm. Wood & Co. New York, $5.00. Report of the Secretary of the Interior to June 30, 1882. Natural Science in Secondary Schools, F. Mühlberg, pp. 9. Instruction in Morals and Civil Government, A. Vessiot, pp. 4. Trumbull, Reynolds & Allen's 12th Annual Catalogue. Circulars of Information of the Bureau of Education, No. 3, 1882. The University of Bonn,—National Pedagogic Congress of Spain,—High Schools for Girls in Sweden. Thirteenth Annual Report of the American Museum of Natural History, Central Park, N. Y. Fifth Annual Announcement of the Fulton & Trueblood School of Elocution and Oratory. Constitution and By-Laws of the Iowa State Academy of Sciences. Yellows in Peach Trees, D. P. Penhallow, Boston, 1882, pp. 8.

SCIENTIFIC MISCELLANY.

LIBERTY ENLIGHTENING THE WORLD.

The people at large are to have the opportunity, it is stated, to subscribe toward the fund for the pedestal upon which Bartholdi's statue of "Liberty Enlightening the World" is to be erected in New York Harbor. It is especially desirable that the "people at large" in the United States should do this for the reason that the present is from the "people at large" in France; and it is thought meet that it should be received in the spirit in which it is given—namely, as a testimonial of affection from one liberty-loving people to another. It is the first time that such a substantial evidence of international amity has been furnished in the history of the world. If it were not for the carrying out of the idea that the whole people should have something to do with the reception of the gift the money for the pedestal could be readily raised in New York in a day. Sufficient indications of the truth of this proposition appeared at the great mass-meeting at the Academy of Music, in that city, held on Tuesday evening last, to set the ball in motion to prepare the base for the statue which is nearly completed. Just what arrangements have been made to collect the funds is not stated, but they doubtless will be effectual.

The figure itself will be the most remarkable structure of the kind ever created. The Colossus of Rhodes was only 105 feet high. This statue will be 155 feet, and will be mounted on a pedestal of equal height, the whole arrangement being placed on Bedloe's Island, which is just about large enough to receive it comfortably and is situated just where it is wanted for the purpose. It will thus tower some 300 feet above the water level—a most imposing feature by day and a light-house by night whose beacon will be seen far and wide. The cost of this gift to the French people will amount to about 1,250,000 francs, and it will cost us about the same ($250,000) to furnish the pedestal. Besides its value as a testimonial and as a light-house it will be a triumph of art. A finely built goddess of liberty holding a lighted torch 300 feet in the air and welcoming ships and people of all nations to the chief seaport of a free country and of the new world, is a fine idea from an artistic point of view, especially when it is remembered that it was constructed jointly by the peoples of the two principal republics in the world. It becomes a figure full of significance and promise and will throw a little relief of poetry upon the otherwise prosy and business-like appearance of the harbor.

The above is from the *Globe-Democrat*, and we quote below a very interesting description of the statue from *Harper's Weekly* of January 6, 1883:

M. Bartholdi, the ingenious and daring designer of this statue, is already famous

for the skill with which he has handled colossal subjects; for apart from the genius necessary to form a grandiose conception of such a work of art as that with which the friendship of the two great republics of the world is to be celebrated, there is required no small amount of mechanical knowledge to bring it to completion. The resources of modern mechanics render this a matter of comparative certainty. The sculptor is no longer required to perform such prodigies of labor or to undergo such agony of suspense and fear as those described by Benvenuto Cellini in his letters, recently published, containing an account of the casting of his "Perseus" and "Medusa." But though the artist of to-day goes about his task with confidence in its accomplishment, the erection of a statue of more than 155 feet in height—not counting the pedestal—to stand in an exposed situation, unsheltered by adjacent structures, is decidedly the most gigantic enterprise of its kind.

The work is now going on in the yards of Messrs. Gaget, Gauthier & Co., in Paris. The hand alone will be 5 metres (16 feet 5 inches) in length; the index finger will be 2.45 metres (a trifle over 8 feet) long, with a circumference at the second joint of about 7 feet 6 inches; and the nail of this finger will present a surface about 13 inches by 10. These figures will give some idea of the enormous dimensions of the statue. Those who have a liking for other means of calculation may be interested in knowing that the whole statue (without the pedestal) will overtop the famous Vendôme Column more than nine feet; that in the head forty persons can assemble, and in the torch at least a dozen more. The statue, as is well known, is to be hollow, and is to be literally "built" of plates of hammered copper nine-tenths of an inch in thickness. The method of construction is curious and interesting. The first essential was, of course, the "sketch model" of M. Bartholdi, which was what may be called life size, being 6 feet 7 inches in height. This was the basis of the measurements, which, however, were twice multiplied. It was first magnified four times, and reviewed and remodeled by the artist. It was then divided into sections, which are reproduced four times larger yet, with the greatest possible care. Models in plaster of the final and definitive size are made in the vast yards. The workmen first sketch the general form in frames of wood covered with laths and recovered with a coat of plaster. They then verify the principal measurements thus established, and finish the modeling of the surfaces and the details. When a course is finished, joiners take the forms by means of planks cut in *silhouette* to fit the form of the plaster.

These are then so arranged together as to form a species of imprint of the parts to which they have been applied, and make what are technically termed *gabaris*, or wooden moulds, into which the hammerers pressed the copper sheets by the pressure of levers, or by beating with hammers. The copper is then finished by beating with smaller hammers or rods, outside and inside, to conform closely to the lines of the forms desired, which have been taken in detail by means of sheets of lead pressed upon the model. The workman in doing this part of his task places himself directly before the plaster models, and compares

every part as he proceeds with the utmost patience and exactness. This done, the separate pieces are carried to an immense court to be placed together, and fixed upon a powerful frame-work of iron, which supports what may be called the entire envelope of the statue. When the statue is removed for transportation, it will be taken apart in more than 300 pieces. Its entire weight will be some 450,000 pounds, of which over 200,000 pounds will be copper, and the remainder the iron frame-work.

The workshops and yards of Messrs Gaget, Gauthier & Co. are thrown open to the subscribers to the statue, to witness the process of construction, on Thursdays and Sundays of each week, and the pupils of the School of Fine Arts are also admitted free. Those who are not subscribers can obtain admission by purchasing an engraving of the monument, which is sold for the benefit of the work, in all sizes and states of perfection, from those costing ten cents only to the elaborate representations of the various parts. The place is much frequented, particularly on Sundays, which is the Parisian holiday for all sorts of diversions, from sight-seeing to a revolution. The great yards are a veritable spectacle in themselves, but the motley gathering of visitors is still more of one. The workmen in their caps and blouses are a noticeable element, and occasionally an impromptu orator will address his chance audience with a glowing eulogium of America in terms which the wandering citizen of this happy land does not always recognize as truthful, and sometimes thanks Heaven that they are not. But the impressionable hearers drink in the praises of the ideal republic with eagerness, and reward the speaker with cries of "Vive la Liberte!" "Vive la Republique Americaine!" The great work of M. Bartholdi has, moreover, been carefully inspected by many of the sculptors and engineers of the Continent, and has given rise to much discussion as to its probable stability, as well as its artistic merits. The verdict, on the whole, has been one of approval, and there is no reasonable doubt that when it is securely placed on the pedestal which Mr. Evart's committee is to prepare, it will be a worthy symbol of the generous sentiment to the expression and perpetuation of which it is consecrated.

TREATMENT OF NATURE BY AMERICAN AND ENGLISH POETS.

One of the results of my study of American poetry has been to assure myself that certain specific and well-defined causes have worked together to fix, as a characteristic of that literature, a universal tenderness toward "the speechless world," the creatures in fur and feathers that fulfill such great and beautiful functions in our world's economy. This pitifulness, co extensive with nature, may be almost accepted as a new departure in poetry, for I do not find that sympathy with world-life is by any means an invariable rule with poets.

The causes I refer to are not far to seek. In the first place, the popular mind in America is not so familiarized with classical images and allusions as in Europe, and the American poet, therefore, does not recur so readily as his Eu-

ropean congener, to the fancies and mythology of antiquity. In the next, the beasts and birds of the New World are not the same beasts and birds that play such important parts in Old-World fables, give point to Old-World proverbs, and form the object of so many Old-World prejudices and predilections, and the American poet therefore finds his creatures as yet untampered with by antique misrepresentation or popular superstitions. He has not got to rummage for his natural history among the mossy roots of a reverend folk lore, or a heraldry that is sanctified by national associations. The larks, robins, and magpies of America are not the birds that are known by the same names in Europe, and so the poet of the West finds the ground still virgin soil before him. Popular superstition has not had time yet to lichen over the familiar objects of his country-side, and he has thus few temptations to the logicians' fallacy from antiquity. Indeed, there is even noticeable sometimes a tendency toward irreverence for "the widowed" turtle, and a disposition to make fun of the nightingale that "bruised his bosom on a thorn," as if they were antiquated favorites of an obsolete era of thought,

> "Though still the lark-voiced matins ring
> The world has known so long,
> The wood-thrush of the West still sing
> Earth's last sweet even-song!"

But this, after all, is only a very partial protection, for though some of his beasts, birds, fishes, and insects are new to poetry, the remainder—such as the wolf and the lion, the owl and the raven—are not things of any one time or place. Thus an American raven flies with just as "prodigious" a flight as a Scotch one or a Roman; the owl and vulture might be quite as "obscene" in "Evangeline" or "Mogg Megone" as they are in Wordsworth or Cowper. But I do not find Longfellow or any of his fellow-countrymen taking advantage of the license of poetical prejudice extended to them by high prescription. On the contrary, they compassionate the raven, and handsomely meet the vulture and the owl with a compliment. They speak ill of nothing. And I can not, for myself, help admiring this absence of cynicism. They are as gentle always as Keats, while in their more general passages they show all Shelley's appreciation of the harmonious unity in nature:

> "Come, learn with me the fatal song
> Which knits the world in music strong,
> Whereto every bosom dances,
> Kindled with courageous fancies;
> Come lift thine eyes to lofty rhymes,
> Of things with things and times with times,
> Primal chimes of sun and shade,
> Of sound and echo, man and maid,
> The land reflected in the flood,
> Body with shadow still pursued,
> For Nature beats in perfect tune,
> And rounds with rhyme her every rune!"

Apart, therefore, from the specific causes to which I have alluded, there must be sought some larger, more national influence at work to account for this complete catholicism in kindliness. Nor somehow is it difficult, so I think, to imagine the poets of a country with some distant horizons as America, so vast in certainties, so infinite in possibilities, refusing to limit their sympathies to merely continental boundaries, or to cramp their interests within the domains of any single crown, or "hop about from perch to perch in paltry cages of dead men's dead thoughts." Accustomed to such large maps, they may be easily supposed to be intolerant of geographical prejudices, and priding themselves before everything upon independence of thought, may have carried their sympathy with an unconventional freedom into their treatment of natural objects. "Our country hath a gospel of her own." For myself, I am content to believe this, and to attribute their just recognition of the place of animal and insect life to the large-hearted tone of American intellectual thought. And I would not know where to go for a more adequate statement of the poet's means and ends in nature than Emerson's "Wood Notes," or for thoughts more fully in sympathy with nature than Longfellow's or Whittier's, with his ear "full of summer sounds." Lovers of wild life will find it hard to outmatch Bret Harte's apostrophe to the coyote and the grizzly, Emerson's to the humble-bee, Wendell Holmes' to the sea-fowl outside his study window, or Aldrich's delightfully appreciative touches of wild life. Quadrupeds, birds, insects—everything that has life is looked at kindly and unselfishly apart from human interests, and this, too, with a respectful sympathy that bespeaks something more sincere than Cowper's lip-service or Pope's acidulated praise. Our furred and feathered fellow-beings, seniors to ourselves in existence, though subjected to us, are not, as in the European poets, accepted as mere accidents of the human economy, or as secondary properties of man. They seem to remember—unless it be only my own whimsical interpretation of their tenderness—that our earth is the other creatures' earth too, that they are a creation of themselves, that each had a day set apart for itself, a morning and an evening, at the first miracle of the world's making.—PHIL ROBINSON, in *Harper's Magazine for February*.

GOLD IN ANCIENT TIMES.

Gold was in excess in ancient times, and mostly taken from the rivers in Asia. The fables of Pactolus, of the golden fleece of the Argonauts, of the gold from Ophir, the history of King Midas, etc., all point to an Eastern origin of this metal. According to Pliny, Cyrus returned with 34.000 Roman pounds of gold, (about $10,000,000). The treasures exacted from Persia by Alexander the Great amounted to 351,000 talents, or $400,000,000. Gold also came from Arabia, and upon the Nile from the interior of Africa. Pliny calls Asturias the country in which the most gold is found. A tablet bearing the following inscription was

found in Idanha Velha, Portugal: "Claudius Rufus returns his thanks to Jupiter for having permitted him to find one hundred and thirty pounds of gold."

The sources of wealth have ceased to flow, and the endeavors of several Englishmen to reopen them have been unsuccessful. Bohemia, Mähren, Silesia, and Tyrol, all have produced gold, and the receding of the glaciers has caused old mines to be uncovered, while upon the Italian side, at Monte Rosa, Val Sesina, and Val Ansaca, gold mines are still worked to-day, although with indifferent success. The only works of any note are those of Kremnitz, Hungary. It may, therefore, be safely asserted that Europe is completely exhausted in this respect.—*From "The Decrease of Gold," by* F. VON BRIESEN, *in Popular Science Monthly for February.*

SOME RECENT IMPROVEMENTS IN THE MECHANIC ARTS.

BY F. B. BROCK, WASHINGTON, D. C.

COMBINED SAD-IRON HEATER AND MEAT-ROASTER.—This novel invention has its base provided with a heating chamber to receive the irons. A lid or cover is hinged to the base and drops automatically over and covers the heating chamber. It is provided with slots open at their outer ends to receive the handles of the irons, and a slide is placed on the under side of the lid and is provided with a series of slots open at their outer ends and coinciding with the slots in the lid. Mechanism is provided whereby the slide may be moved laterally for the purpose of opening or closing the slots in the lid.

AUTOMATIC FEED-WATER REGULATOR FOR STEAM BOILERS.—This new automatic feed-water controller for steam-generators consists of an upright cylindrical chamber, communicating with the steam and water spaces of the boiler. The chamber has also a steam eduction port communicating with the actuating cylinder of the feed-water pump. A float is arranged to control the egress of steam from said chamber, and a horizontal disc is suspended from the float and spans the chamber to receive a direct vertical water-pressure, thereby overcoming any suction that may be exerted on the float by the steam-eduction port.

STEAM PACKING MATERIAL.—A late invention consists of a steam-packing material composed of granulated strips or shavings of cork, asbestos and dissolved gum, covered with a layer of asbestos and linen.

METHOD OF STRETCHING BELTS.—An improved process for stretching belts for machinery consists of first opening the belt through its entire length, then stretching it over two or more rollers and connecting the ends by a suitable stretching device and finally applying tensile strain to its two ends and increasing it from time to time, until elasticity of the belt is exhausted.

DEVICE FOR RAISING AND LOWERING ELECTRIC LAMPS.—A recent invention designed for raising and lowering electric lamps, consists of supporting-cables secured at their ends to the walls of the building. A carriage is provided having pulleys adapted to travel upon the supporting cables, and insulated brackets secured thereto have also pulleys for the reception of the cables. A cross-beam, having at each end thereof a grooved pulley, is pivoted to the insulated bracket to adapt it to travel upon the carriage supporting cables. The cables are rigidly secured to the cross-beam and pass over the insulated pulleys upon the carriage to the lamp suspended below. Conducting wires connect the positive and negative wires of the circuit with the supporting cables and the insulated pulleys of the cross-beam, are also connected with the supporting cables.

AFRICAN EXPLORATION.

Foreign dispatches have lately contained frequent allusions to the controversy between the explorers, Stanley and DeBrazza, regarding the French claims on the valley of the Upper Congo. The New York *Herald* gives a sketch of the whole matter. DeBrazza went into the service of the French branch of the African International Society in 1875 to seek a trade route from the coast up to Stanley Pool, the point where navigable water extending 900 miles into the interior begins. His first journey was along the Ogowe, following that river to the mountain, and then striking the Congo at Stanley Pool. Subsequently he advocated another route, starting from the west coast at Banga, and reaching the Congo at the same point. Mr. Stanley's route was by way of the Congo all through, passing the series of falls that obstruct navigation between the Lower and Upper Congo by means of roads, or eventually of canals, if ever commerce should justify such extensive works.

M. DeBrazza's original route was some 500 or 600 miles longer than Stanley's. His second route, from Banga, is also of much greater length than along the banks of the Congo. On the 10th day of September, 1880, DeBrazza, having reached Stanley Pool and established himself with King Makoko, obtained from the latter an agreement to the celebrated treaty ceding the territory on the north side of the Pool to France. Stanley had explored the Congo in his trip to finish Livingstone's work, and in 1879 he went back there in the service of the Belgian branch of the same society which had started DeBrazza out. When Stanley, proceeding up the river, had passed the last cataract and reached the navigable waters extending from the Pool inland, he found DeBrazza's lieutenant, Malamine, with two seamen in possession of a station on the north bank, and the natives refused to give him the right to establish a station there, because they had given it to the French. He, however, was well received by the chief on the south bank, and there built a station of 113 houses. He then, having launched his steamers, proceeded to explore the Coango, a main tributary of the Congo. After ascending it 150 miles he found a lake 70 miles long and 6 to 30 miles

broad, which he named in honor of the King of the Belgians, Leopold II. Stanley says the Belgian stations, 5 in number, which he established, are commercial in a sense that they are expected to be self-supporting and that the King is interested in Africa in a spirit of a philanthropical geographer, simply as a man who lives the dear old continent for which he has always felt a sort of respectful melancholy. Stanley says the French have had a colony at Gaboon since 1857, and never heard of the Congo until they read of it in the *Herald* and London *Telegraph*. He argues nothing from DeBrazza's occupation of the north bank at the Pool, even should the French Government ratify his treaty and persuade the natives to respect it. He wants a series of international posts maintained, with the river free to the traders of all nations.—*American Inventor.*

MICHAEL ANGELO.

W. W. STORY.

The overthrow of the pagan religion was the deathblow to pagan art. The temples shook to their foundation and art withered in her crumbling shrine. When through the ancient world was heard the mournful cry, first echoed by the sunlit waves of the Ægean sea, "Great Pan is dead!" then the nymphs fled from the hallowed groves of Arcadia, and were seen no more. The hamadryad deserted her oak and the naiad her fountain. Of all the great tribes to which the poetic and religious instincts of Greece and Rome bowed, only Orpheus remained, and he was transformed into a monkish saint. Christianity struck a deathblow not only to pagan art, but to all art, which atrophied and shrunk for centuries, until, driven out of the rest of the world, its sickened and diseased body found refuge in some monastery. The statues of the gods were overthrown and buried under the earth—those wonderful creations of beauty which voice the highest demands of humanity. Only bloodless saints remained. Humanity trembled in the grasp of an iron-cased bigotry. Youth and beauty and joy were suppliants, where once they were free and prince-like. Religion and art, which cannot live apart, were divorced. The long, dark night of the middle ages came on—a night without a star, and the blackness of a sordid ignorance blotted out all fair sights or scenes. Only arms remained. For music and poetry, and sculpture and science there were only the butcheries of the battlefield. But the seasons of the soul are like those of nature. After the long, cold winter of the dark ages came the springtime of the renaissance—the new birth of humanity. The church awoke. Guelf and Ghibelline began their memorable contest. Commerce flourished, and art, literature, science, religion itself, burst into new and vigorous life. Then flashing from the firmament of mind the brilliant stars of art and literature shone out in lambent glory—Dante, Boccaccio, Petrarch, Filomena, Machievelli, and all that bright galaxy of lights that cast a morning radiance far back even into the hideous night that had preceded it. Music took

upon herself a fairer form, art blossomed into most fragrant fruition, science itself awoke from its sleep and began its wonderful course. The marble gods that had lain so long beneath the earth arose from their graves and reasserted their dominion over the souls as they had formerly wielded it over it the minds of men. Here lived and wrought Leonardo Da Vinci, the most versatile and comprehensive intellect the world has ever seen; Angelo, the greatest power that ever worked on stone; Raffaelle, the soul of beauty and grace, with his pencil dipped in the colors of Paradise; Titian, who stole from the sunset the secret of its hues; Gallileo, Columbus, and many others. These were the men who lived with, or immediately preceded, Michael Angelo. It was the renaissance, the morning after the night. As Italy is above all others the land of the renaissance, so is Florence above all other places in Italy the city of its new birth. There is scarcely a street in that beautiful city, or a square, that has not something to say of the brilliant glories it once shared. One walks the city guided by memory rather than by vision. The old families still give their names to the streets. The whole city is filled with ghosts, even in whose pallor we can read what was the blush and bloom of her flowering days.

Then brilliantly and gracefully, the lecturer drew a brilliant and graceful sketch of the Tuscan capital in the days of its glory, and described the treasures of art that are heaped there—the Duomo, the Campanile, the Palazzo Vecchi, its beautiful churches, its wonderful statues, its marvelous paintings. Lingering a moment over the mighty memories of Brunelleschi, of Dante, whose statue the city jealously guards, though the justly indignant poet would not let her have his bones; of Savanarola, of Giotto, and the hundreds of other names that have immortalized *la bella Florenza*, he briefly sketched the life, the works, the character of Michael Angelo Buonarotti. Poet, painter, sculptor, architect, engineer, he was supreme in each and unapproached in all. Born in 1474, of noble, if not of royal blood, he lived and worked incessantly for ninety years. His capacity for work was marvelous. He accomplished the impossible, and overcame the insuperable. As a sculptor, his grand and glowing genius is above the rules of the schools, having sought and found on the white steeps beyond human power the law which governs and the soul which inspires his wonderful creations. No name other than that of Phidias may be mentioned with his. As an artist he taught even Raffaelle, and the latter learned from the lesson a still more graceful touch and a still loftier, serener beauty. As an architect, the grandest fabric ever wrought by man swings in the mid air of Rome to attest his supreme genius, the dome of St. Peter's, which is the lofty brow encasing the brain of the church. As an engineer, the stubborn defense of his native Florence is a competent witness that as a soldier he could have been as great as an artist. As a poet, though he swept no Lydian strains from his lyre, yet the clear, sweet, piercing melody of his song sweeps the eternal heights with no uncertain sounds. As a man he was well nigh perfect. His sentiments were cast in the same mould as was his lofty intellect. Pure, high minded, magnanimous, generous, brave, just, and true, his life unspotted by a single stain, there is nothing sordid, nothing mean, nothing

low in his whole composition. *Noblesse oblige* was borne with him in his every fibre. He was impatient of everything low or mean, and his temper was, like his nature, fiery and impetuous. Yet he was always forgiving, always gentle, unless his dignity as a man was insulted. He was never peevish nor irritable. He led a lonely life. Kind to all and lavish of his slender means in the alleviation of want or of misery, he yet had no intimates. He had no friends but two. and yet think who were those two. Savanarola and Vittoria Colonna. It is probable that he loved the latter, but it was a love in which sense had nothing whatever to do. In the lofty, serene regions where his giant spirit lived the atmosphere was too pure and rare for the senses to dwell. She must indeed have been a woman of the loftiest and most perfect type, this famed Vittoria di Collonna, to have won Michael Angelo's love.

Popularly most famous for his work in the Sistine and Pauline chapels at Rome, and for the dome of St. Peter's, his lofty genius is best shown in the chapel of the Medici attached to the church of San Lorenzo in Florence. Here the mausoleum of the Medici commands an attention which, once given, is given always. The great figures of "Day" and "Sleep" and "Night," of "Aurora" and "Crepuscule," enchain the beholder. These figures are tremendous. Looking at them you are brought to know what thoughts fill the human breast when the perfection of human intellect grapples with the mysterious problems of man's origin and destiny. They are the symbols of humanity's struggles with the tremendous and unseen forces of nature. A great intellect has flung itself into the marble and wrought out thoughts rather than human beings. Michael Angelo is the one man who has sculptured ideas. These statues are not Greek, and belong to a different race. The Greek sculptured beauty in repose—his gods, when they suffer, are serenely majestic, and they smile calmly even with the fox gnawing at their vitals. Even in the Laocoon the suffering is subdued grace. But Michael Angelo belonged to a different race. The mysterious Etrurian, whose civilization was old and gray and heavy with the weight of his own completeness ere a stone was laid on the seven hills by the Tiber, transmitted to Michael Angelo along with his blood, his sombre thoughts and his mystic moods. Etrurian, and not Italian, no tradition of Aryan race inspired his soul or informed his mind. He was of the old gods; he dwelt with Saturn and Hyperion beneath the dim umbrageous recesses of the woods, rather than with Jove and Apollo and the other deities of the new era. And the tremendous truths caught and known by an older and truer civilization than the world of his day knew has left their giant shadows as an incubus on his soul.

The artist pictured the difficulties he labored under in his great work of painting the Sistine chapel, described the wonderful productions of his genius on those walls and ceilings, drew a beautiful comparison between him and Raffaelle, who was in most cases his antithesis; related the subsequent life of Michael Angelo, sketched his character with a light but bold touch, and closed with a magnificent picture of the Medici Mausoleum, when the tombs were opened in 1857 and the bodies, many of them, were found plundered of their ornaments. "There

lay the dishonored dust of the Medicean rulers of Florence, discrowned and plundered, not even safe in death from outrage and disgrace, while the artist that they patronized and thought beneath their rank now wears a crown of immortality at which the world willingly bows down."—*National Republican.*

CUVIER.

As the scope of this magazine enables it to cull from all sources we gladly place before our readers an account of the early life of the great anatomist taken almost bodily from the pages of the late George Henry Lewes and which has probably met the eyes of but few of our readers.—[ED.

It was a dream of the youth Cuvier that a history of Nature might be written which would systematically display the unusual dependence of one organ of an organism upon another. It was in the Academia Carolina of Stuttgardt that in 1787 Cuvier, Pfaff (the once famous supporter of Volta), and a small circle of fellow students, who particularly devoted themselves to Natural History, formed a society of which Cuvier drew up the statutes and became the president. They read memoirs, and discussed discoveries with all the gravity of older societies, and even published among themselves a sort of *Comptes Rendus.* They made botanical, entomological and geological excursions, and still further to stimulate their zeal Cuvier instituted an order of merit, painting the medallion himself; it represented a star with the portrait of Linné in the centre, and between the rays various treasures of the animal and vegetable world.

At this period Cuvier's outward appearance was as unlike M. le Baron, as the grub is unlike the butterfly. Absorbed in his multifarious studies, he was careless about disguising the want of elegance in his aspect. His face was pale, very thin and long, covered with freckles and encircled with a shock of red hair. His physiognomy was severe and melancholy. He never played at any of the boys' games. He was reading all day long and a great part of the night. No work was too voluminous or too heavy for him. "I remember well," says Pfaff, "how he used to sit by my bedside going regularly through Bayle's Dictionary." It was during these years that he laid the basis of that extensive erudition which distinguished his work in after life. It was here also that he preluded to his success as a professor, astonishing his friends and colleagues by the clearness of his expositions, which he rendered still more striking by his wonderful skill with the pencil. Cuvier's facile pencil was always employed; if he had nothing to draw for his own memoirs or those of his colleagues, he amused himself with drawing insects as presents to the young ladies of his acquaintance—an entomologist's gallantry which never became more sentimental.

In 1788, that is in his nineteenth year, Cuvier left Stuttgardt for Normandy, where he lived till 1795 as tutor in a nobleman's family. Here he was discovered by the Abbe Tessier who sent some of his manuscripts and drawings to Paris which, falling under the eye of Geoffroy St. Hilaire, who though younger than

Cuvier was already a professor at the Jardin des Plantes, he at once wrote to Cuvier "Come and fill the place of Linnæus here; come and be another legislator of Natural History." Cuvier came and Geoffroy stood aside to let his great rival be seen.

Goethe has noticed the curious coincidence of the three great zoölogists successively opening to their rivals the path to distinction. Buffon called Daubenton to aid him, Daubenton called Geoffroy and Geoffroy called Cuvier. Geoffroy and Cuvier knew no jealousy then. In after years it was otherwise.

Geoffroy had a position—he shared it with his friend; he had books and collections—they were open to his rival; he had a lodging in the Museum—it was shared between them. Daubenton, older and more worldly wise, warned Geoffroy against this zeal in fostering a formidable rival, and one day placed before him a copy of La Fontaine's fables open at *The Bitch and Her Neighbor*. But Geoffroy was not to be daunted, and probably felt himself strong enough to hold his own. And so these two happy active youths pursued their studies together, wrote memoirs conjointly, discussed, dissected, speculated together—and as Cuvier has said "never sat down to breakfast without having made a fresh discovery." From this time on Cuvier was famous, but the real foundations were laid in those seven years on the Normandy coast when every animal he can lay his hands on is dissected with the greatest care and every detail of interest preserved with the pencil. Every work that is published of any importance in his line was read, analyzed and commented upon. The marvels of marine life, in those days so little thought of, he studied with persevering minuteness and admirable success. He dissected the cuttle fish and made his drawings with its own ink. Six years later, Pfaff on arriving at Paris, found that his old fellow student was "a Personage," yet his life was simple and wholly devoted to science. He had a lodging in the Jardin des Plantes and was waited on by an old housekeeper, like any other simple professor.

On Pfaff's subsequent visit, things were changed. Instead of the old housekeeper, the door was opened by a lackey in grand livery. Instead of asking for "Citizen Cuvier" he inquired for Monsieur Cuvier; whereupon the lackey inquired if he wished to see Monsieur le Baron, or M. Frederic his brother. "I soon found where I was," says Pfaff. "It was the baron separated from me by that immense interval of thirty years and by those high dignities which an empire offers to the ambitions of men." Cuvier had almost entirely exchanged science for politics and here we leave him.—*Scientific and Literary Gossip.*

EDITORIAL NOTES.

OWING to a variety of causes, including illness, delay in obtaining suitable paper, change of business location, etc., it was impracticable to get out the January number of the REVIEW; hence we issue a double number this month, which we hope will at least come as near satisfying our subscribers as it does us, and that is not very close.

IT is thought that tin ore has been discovered in Texas. Miners have sent sample specimens to Prof. John D. Parker, of Fort McKavett, asking him to have the matter authoritatively determined. These specimens have been submitted for examination to three eminent chemists, and when the analyses have been made and reported, the results will be duly published in this REVIEW. Miners claim that the ores are undoubtedly those of tin, and say that the ores are rich, and that the mines can be worked with profit.

THE American Society of Microscopists, which held a very successful meeting at Elmira, N. Y., in August, 1882, elected Albert McCalla, A. M., of Fairfield College, Iowa, President, and selected Chicago as the place for the meeting of this year and fixed upon the 7th day of August as its date.

On January 15th blue-birds were seen in this city and wild geese observed flying north; on the 19th the mercury averaged 8° below zero all day.

HENRY N. COPP, of Washington City, has added to the list of similar books written and compiled by him, one entitled "The Settlers' Guide," which contains about all that a person going into any of the new Territories to locate himself need want to know of the laws and rules applicable to locating Government lands of any kind. 25c.

THE Fifteenth Annual Report of the Peabody Museum of American Archæology is before us. Professor Putnam's energetic and enthusiastic temperament and habit are visible all through it, from the scheme for raising funds for prosecuting his favorite study to the extremely successful results of his summer's work and the valuable additions to the museum, as reported.

WE are indebted to Dr. A. B. Stout, of San Francisco, for a copy of the several articles published, in the Transactions of the California Academy of Sciences, upon the peculiar foot-prints discovered in the rock at the Nevada State Prison. They were at first supposed by several *savans* to be human foot-prints, but it is now pretty unanimously admitted that they are the tracks of one of the huge lizards of that period of the earth's history.

SINCE our last issue the list of the Jackson County Flora by Mr. Frank Bush, of Independence, then announced, has been published in a neat pamphlet and laid upon our table. It appears to be very full and complete. Mr. Bush is to be thanked for doing so laborious and difficult a work so thoroughly.

THE Historical Society of St. Louis is taking measures to raise funds for the erection of a suitable building for the accumulation and preservation of appropriate material, which is very abundant within and in the vicinity of that city. The building is to cost about $75,000.

If the Kansas City Academy of Science, which includes among other branches a section of Local History, could raise one-fourth as much or even $10,000 for the erection of a building, its collections and library would soon be an object of pride to every intelligent citizen.

FOR the coming year Professor Lovewell will do his meteorological work in connection with the Board of Agriculture, having been appointed State Meteorologist of Kansas.

A bill was introduced in Congress on January 8th, by Hon. Mr. Anderson, of Kansas, for the construction of a railroad and wagon bridge over the Missouri River at Leavenworth City.

AT the meeting of the Kansas State Historical Society the address of Hon. T. Dwight Thacher was a most important and valuable contribution to its literature. It was a full, accurate, analytical history of the four constitutional conventions of that State and their doings, together with brief accounts of several of the prominent members thereof. As a model of condensed history it should be, as it will be, carefully preserved among the papers of the Society.

IT is certainly a great gratification and a source of no small degree of hope, that a Government officer's report can be published and distributed before the end of the year to which it pertains. We refer to Prof. C. V. Riley's Report as Entomologist of the Department of Agriculture for the year ending June 30, 1882, which was issued in December, 1882. It is, as is always the case with Prof. Riley's published papers, full, complete, valuable and handsome in execution.

THE Memphis extension of the Kansas City, Ft. Scott & Gulf R. R. is now completed, and regular trains running to West Plains, Howell County, Mo., 315 miles from Kansas City. The line will reach Augusta, Oregon County, Mo., about February 20th, and will be completed and open for business to Memphis, Tenn., about June 1, 1883. This is a result of great importance to Kansas City and the west. A Kansas City and Memphis railroad was projected many years ago, and work upon several lines commenced at different times, but for many reasons none has been effectually pushed until now.

PROF. NIPHER'S bill for a State Weather Service in Missouri ought to be passed without hesitation, as it will be of the greatest service to the agricultural interests and will cost a very small sum to establish it.

The bill only asks for $1,000 for the purchase of instruments for 114 observers, or one for every county, and it asks for the next two years a sum of $1,500 annually for the payment of actual expenses, including the hire of a clerk at the central office at $700 a year. The bill provides that no money shall be paid as salary to the Director, or to any other officer or member of the service. The Director and trustees are to be appointed by the Governor, and are to account to him in detail for the money expended.

It is intended to use this sum in giving daily and systematic study to our local storms, the reports being sent by mail each day from the stations. It is expected that in two years enough will be known of our storms to justify the commencement of harvest warnings. Each harvest rain does damage enough to pay the expense of weather service for years.

IS it to be credited to Shakespeare as scientific foresight that at the very time, 1603, when Dr. Gilbert was groping blindly amid the simplest experiments in magnetic attraction, he put into the mouth of King Lear, when apostrophizing the lightning, the prophetic words: "You sulphurous and *thought-executing fires*"?

ITEMS FROM PERIODICALS.

Subscribers to the REVIEW *can be furnished through this office with all the best magazines of the Country and Europe, at a discount of from 15 to 20 per cent off the retail price.*

THE *Northern Indiana School Journal* is now in its third year and is certainly one of the best educational magazines that comes to our table. It is a monthly octavo of 48 pages, filled with wholesome and valuable matter adapted to scholars and teachers, edited and published by Prof. W. J. Bell; at Valparaiso, Ind., at $1.25 per annum.

PROF. OTIS T. MASON, of Columbia College, Washington City, in the November *American Naturalist*, to which we have so often referred as one of the very best scientific magazines published, refers with much pride to the growth of anthropology as a science. He deprecates the idea that every gatherer of old bones and arrow-heads is a scientist, but insists upon it that the subject is of the highest value scientifically and that each of its branches, named by him, respectively, Anthropogeny, Anthropography, Anthropology and Anthroponomy, will afford ground for the deepest researches and profound philosophy. The meetings of the Anthropological Section at the Montreal meeting of the American Association were largely attended, and most of the papers read were able, instructive and interesting.

REV. S. D. PEET, editor of the *American Antiquarian* continues in the January number his interesting and well written articles upon ancient village architecture in America, including Indian and Mound-Builder's villages, —also several suggestive editorials. Albert S. Gatschet a well-known anthropologist of the Smithsonian Institution, contributes a paper upon the Chumeto Language. Mr. Read's description of the Old Pecos pueblo differs so widely from our own personal observations in 1880, that if it were not for his reference to the ruin of the ancient Spanish church, we should hardly recognize it as applying to the same place. The oriental notes are a very attractive feature. The *Antiquarian* is the only periodical in the country wholly devoted to archæology and deserves a liberal support.

THE *Atlantic Monthly* presents for 1883 an array of contributors not excelled in number or ability to instruct and entertain by any magazine in the country. Oliver Wendell Holmes, who has resigned his professorship in Harvard University in order that he may devote himself more fully to literary pursuits, will write exclusively for it; Henry James, Jr., will write essays, criticisms, etc., in addition to his dramatized version of "Daisy Miller;" W. D. Howells will send from Europe the results of his observations in travelling through Europe; Charles Dudley Warner will contribute several of his characteristic sketches, while both Longfellow and Hawthorne will be represented by a dramatic poem and a novel, respectively, left by them nearly completed. Besides all this the usual variety of serial and short stories, essays, poetry and reviews of current literature will serve to keep the *Atlantic*, now in its fifty-first volume, fully up to its regular standard of excellence.

NUMBERS 38 and 39 of the *Humboldt Library*, published by J. Fitzgerald & Co., New York, present "Geological Sketches," by Prof. Archibald Geikie, LL.D. Nothing can be more interesting or instructive than these sketches, and the publishers are to be credited with rare good judgment in the selection of the articles they reprint from month to month. 48 pages octavo, well printed, for 15c.

THE *U. S. Monthly Weather Review* for November, 1882, has reached us in new and improved form. It is now stitched and bound with a neat paper cover and trimmed. Even the weather maps are fastened in, so that it is some satisfaction to handle the *Review*. If the Chief Signal Officer will now have the the numbers enclosed in envelopes, for mailing, as are those of the *Official Gazette* of the Patent Office, instead of folding them, it will be an additional improvement.

WE observe that a weekly scientific magazine after the style of *Nature*, and to be called *Science* is about to be started in Cambridge, Mass., under the management of Prof. A. Graham Bell. We wish it success and feel sure from the character of the gentlemen connected with it that it will occupy a high position and maintain itself without resorting to any such dishonorable practice as its late namesake of New York has done for a very small consideration within the past year.

THE *North American Review* for February opens with a symposium in which six prominent theologians, representing as many religious denominations, give expression to their views upon the question of the "Revision of Creeds." Prof. Alexander Winchell, in an article entitled "The Experiment of Universal Suffrage," institutes a profound inquiry into the essential conditions of stable popular government, which he finds to be, substantially, virtue and intelligence; but these conditions, he maintains, are absolutely unattainable under our existing political system, where an electorate either ignorant or vicious, or both, by the mere force of superior numbers, practically nullifies the suffrages of the better and wiser portion of the people, whose right to control the government of the commonwealth is grounded in the very nature of things. Bishop McQuaid writes of "The Decay of Protestantism," and in essaying to prove his thesis, makes a very adroit use of admissions of the protestant writers. "The Political Situation" is the joint title of two articles, the one by Horatio Seymour, the other by Geo. S. Boutwell, who offer their respective views upon the causes of the recent overthrow of the Republican party. An article by Dr. D. A. Sargent, on "Physical Education in Colleges," treats a subject of prime importance to the welfare of the youths in our higher educational institutions. Finally, there are two articles on "The Standard Oil Company," Senator Camden of West Virginia defending that corporation against its assailants, and John C. Welch setting forth the reasons for condemning it as a dangerous monopoly. Published at 30 Lafayette Place, New York.

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